LEADING CAUSES OF MORTALITY

North Carolina Vital Statistics 1988—Volume 2

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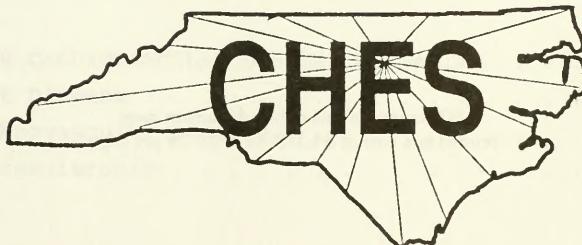
Center for Health and Environmental Statistics
N.C. Department of Environment, Health, and Natural Resources
Division of Statistics and Information Services

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NORTH CAROLINA

Department of Human Resources Regions

Western Region I

North Central Region II

South Central Region III

Eastern Region IV

FIGURE 1.A.

NORTH CAROLINA

Health Service Areas

Western
I

Piedmont
II

Capital
IV

Southern
Piedmont
III

Cardinal Health
Agency
V

Eastern
Carolina
VI

FIGURE 1.B.

The Center for Health and Environmental Statistics produces a major publication annually, describing in tabular and map form North Carolina's mortality experience over the most recent five-year period. Periodically, an expanded volume is produced that includes a narrative analysis for each cause of death. The expanded format is resumed in this 1988 edition, which includes statistical tables, maps, and graphs, as well as discussions of cause-specific trends, geographic patterns, risk factors, multiple conditions present at death, and pertinent research. An overview of the mortality experience in North Carolina is also presented.

The tables in this report provide selected 1988 mortality statistics for counties, Department of Human Resources regions, Health Service Areas, and the state (see maps on preceding pages). More than a dozen of the leading causes of mortality in North Carolina are tabulated; in addition, various cancer sites and total infant mortality are included. Comparisons with national statistics are usually based on 1987 data, which is the most recent year of final data available from the National Center for Health Statistics.

As with previous editions, multiple conditions present at death are discussed in a separate section. Five diseases in particular--septicemia, diabetes, hypertension, atherosclerosis, and nephritis/nephrosis--are considered associated conditions far more often than underlying causes. Hence, Figures 18.A through 22.B display 1984-88 county rates for deaths associated with a

PURPOSE AND ORGANIZATION

Although North Carolina has traditionally experienced low crude death rates, our status among states has worsened. In 1960, only seven of the 50 states had death rates lower than North Carolina's; this had increased to 14 by 1970 (1); 19 by 1980 (2); and 21 by 1987 (3). Furthermore, while many of the state's cause-specific rates are consistently below United States levels, some of North Carolina's age-adjusted rates are substantially higher. For example, cerebrovascular disease, motor vehicle injuries, other injuries, and septicemia are causes for which North Carolina's 1987 adjusted rates were 23 to 35 percent above the corresponding United States rates. For all causes, the 1987 North Carolina unadjusted rate was less than one percent lower than the United States rate, while the age-adjusted rate was six percent greater. Finally, four years of successive decreases in the infant death rate for North Carolina ended in 1987 with a 4.3% increase over 1986, followed by an increase of 4.1% in 1988.

These facts pose a serious challenge to health officials throughout the state to (i) isolate those determinants of mortality that permit intervention, and (ii) identify high-risk areas in order to strategically utilize limited medical and health resources. The data in this volume should aid in these areas of investigation by providing information against which North Carolina's county and regional mortality may be assessed in the present and evaluated in the future.

Nine sections comprise this edition of Leading Causes of Mortality. This section presents an overview of mortality

experience in North Carolina as well as the purpose and organiza-
tion of the document. Section II provides technical information
concerning the calculation, interpretation, and appropriate use
of adjusted and unadjusted rates. As in past editions of this
volume, readers are cautioned about using rates based on a small
number of deaths, and the most problematic of the adjusted rates
are "flagged" in the tables with an asterisk. The procedures
used to determine which rates to flag are described in Section
II. Also, the procedure used to analyze geographic clustering of
counties is described.

Sections III through IX consist of maps, tabular data, and
narrative material which describe North Carolina's recent experi-
ence with respect to general mortality, cause-specific mortality
(underlying cause), infant mortality, and multiple conditions
present at death. For most causes, risk factors, geographic
clustering, differences by race and sex, and trends over time are
considered.

Table 1 describes the selected cause-of-death categories in
terms of codes from the ninth revision of the International
Classification of Diseases (4). Altogether, the 14 major causes
selected for examination in this report accounted for 85 percent
of all North Carolina deaths during 1988. Some of the cancer
sites listed in Table 1 are not discussed separately in this
report. However, the considerable interest in cancer justified
presentation of rates for these sites.

DESCRIPTION OF TABLES

Sections III-IX contain tables that summarize the recent
mortality experience of the state, four Department of Human
Resources regions, six Health Service Areas, and the counties.
Except in the case of infant deaths (Section VIII), a table
corresponding to each cause-of-death category includes the

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following items of information:

1.   the number of resident deaths occurring during 1988;
2.   the 1988 death rate;
3.   the number of resident deaths occurring during 1984-88;
4.   the 1984-88 average annual death rate;
5.   the 1984-88 average annual age-race-sex-adjusted death rate computed by the direct method (5).

The formulas for calculating single- and five-year rates are described in Section II. In this report, general mortality rates (all causes combined) are expressed as deaths per 1,000 population, whereas cause-specific rates are expressed as deaths per 100,000 population. The infant death rates of Table 21, Section VIII, are computed as the number of infant deaths per 1,000 live births.

DESCRIPTION OF MAPS

This volume contains 64 computer-produced maps which depict data for the state's 100 counties. The maps on pages v and vi identify the four regions of the Department of Human Resources (DHR) and the state's six Health Service Areas (HSA's).

In Sections III-IX, maps depicting geographical patterns in mortality should aid in the determination of specific types of health care needs. Up to four maps are shown for each cause-of-death category. Two maps depict the 1984-88 unadjusted death rate and the 1984-88 age-race-sex-adjusted death rate for each of the 100 counties. These maps show six levels of death rates, where level one is the highest rate interval, represented by solid black on the maps, and level six the lowest, depicted by solid white. The interval values (levels) indicated by the map legends are not necessarily continuous, but reflect the actual range of values for each interval. These maps must be viewed

with extreme caution for causes where the number of deaths per county is small, since in these cases rates can be very unstable.

A clustering routine from the Statistical Analysis System (SAS) was used to group counties that are "most like each other" with respect to their unadjusted and then their adjusted rates (6). This procedure may result in very large or very small groups, depending upon how county rates differ from one another.

The other two maps for a particular cause depict "spatial" clustering of two or more adjacent counties with high unadjusted and/or adjusted rates, using a procedure described in Section II. These maps are presented for a given cause only when a statistically significant spatial cluster was found to exist. Unlike the maps described above, these maps are presented in reduced form as part of the narrative and show up to three interval levels of death rates, depending on the number of significant spatial clusters found, along with the significance level (i.e., p-value).

MULTIPLE CONDITIONS PRESENT AT DEATH

Since 1975, multiple conditions present at death have been coded, and statistics are available for all conditions reported by the certifier. Five diseases--septicemia, diabetes, hypertension, atherosclerosis, and nephritis--are considered associated conditions far more often than they are reported as underlying causes. The importance of multiple conditions and the geographic patterns of these five diseases are discussed in Section IX, while the etiology and risk factors associated with septicemia, diabetes, atherosclerosis, and nephritis are discussed separately in Sections IV and VI. County rate tables for these diseases as underlying causes are likewise available in Sections IV and VI. Neither separate discussion nor a county rate table for hypertension is warranted, since it was reported

as the underlying cause for only 283 deaths in 1988.

Tables included in Section IX show deaths cross-tabulated by underlying cause and associated mentioned conditions, death frequencies for selected pairs of mentioned conditions, and death rates based on mentioned conditions rather than underlying causes. Rates are deaths with the condition mentioned per 100,000 population. In addition, ratios of the 14 major causes (plus hypertension and four site-specific cancers) as mentioned conditions versus underlying causes are tabulated.

TABLE 1
MORTALITY STATISTICS FOR 1988 AND 1984-88
NORTH CAROLINA RESIDENTS

Cause of Death — Ninth Revision International Classification of Diseases	Number of deaths 1988	Death Rate* 1988	Death Rate* 1984-88
All Causes	57,630	8.9	8.6
Diseases of Heart (390-398,402,404-429)	19,421	299.4	304.2
Cerebrovascular Disease (430-438)	4,780	73.7	72.5
Atherosclerosis (440)	414	6.4	8.0
Cancer (140-208)	12,700	195.8	183.6
Lip, Oral Cavity, and Pharynx (140-149)	234	3.6	3.4
Stomach (151)	324	5.0	4.9
Colon, Rectum, and Anus (153,154)	1,331	20.5	19.6
Liver (155)	185	2.8	2.4
Pancreas (157)	671	10.3	9.7
Larynx (161)	86	1.3	1.5
Trachea, Bronchus, and Lung (162)	3,669	56.6	51.6
Malignant Melanoma (172)	204	3.1	2.7
Female Breast (174)	1,093	32.5	31.2
Cervix Uteri (180)	142	4.2	4.5
Ovary and other Uterine Adnexa (183)	304	9.0	8.7
Prostate (185)	839	26.9	24.5
Bladder (188)	215	3.3	3.2
Brain Tumors (191,225,237)	327	5.0	4.8
Non-Hodgkins Lymphoma (200,202)	398	6.1	5.5
Leukemia (204-208)	452	7.0	6.5
Septicemia (038)	531	8.2	8.9
Diabetes Mellitus (250)	1,326	20.4	15.9
Pneumonia and Influenza (480-487)	1,930	29.8	27.0
Chronic Obstructive Pulmonary Disease and Allied Conditions (490-496)	2,098	32.3	28.1
Chronic Liver Disease and Cirrhosis (571)	701	10.8	10.0
Nephritis, Nephrotic Syndrome, and Nephrosis (580-589)	469	7.2	8.4
Motor Vehicle Accidents (810-825)	1,598	24.6	24.9
All Other Accidents and Adverse Effects (800-807, 826-949)	1,616	24.9	23.6
Suicide (950-959)	784	12.1	12.5
Homicide (960-978)	578	8.9	9.0

*See Section II.

OVERVIEW OF MORTALITY IN NORTH CAROLINA

Mortality in North Carolina has exhibited a general downward trend in this century, but an upward trend since 1982, rising from a low of 8.1 deaths per 1,000 population in 1982 to a high of 8.9 in 1988. Probably the major factor contributing to this increase is aging of the state's population. Other factors that affect mortality include changes in lifestyle (e.g., reduction in smoking), environment, risk factors, and the medical care system. In sections III through IX of this report, these factors and others are considered in discussing each cause of death. This overview summarizes four general determinants of mortality as well as some of the risk factors which are associated with a number of different causes. Next, some of the major mortality findings are highlighted, and finally, premature mortality in North Carolina is examined via the concept of "years of life lost," which emphasizes the impact of mortality in the younger age groups (7).

DETERMINANTS OF MORTALITY

A broad view of mortality determinants shows that problems "arise from causes embedded in the social fabric of the nation as a whole" (8), and that medical care is only one aspect of health maintenance. Accordingly, environment, lifestyle, biology and genetics, and medical care must all be considered as determinants of health.

Over the past decade, environmental factors, both natural and man-made, have been increasingly recognized as having a signifi-

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cant impact on health. For example, naturally occurring varia-
tions such as water mineral content and elevation have been cited
as influencing the incidence of cardiovascular disease (9). A
more important problem may be the natural occurrence of radon gas
in some homes. However, most serious environmental problems are
consequences of man-made pollution of air, water, and food sour-
ces. Recent examples include atmospheric pollution from lead and
ozone, ground water contamination from toxic wastes, and occupa-
tional exposures to hazardous substances. Children are especial-
ly at risk from pollutants such as ozone (10) and lead (11).

While pollution is a by-product of a high-technology,
growth-oriented society, concomitants of economic growth also
include jobs, income, health insurance, and improved access to
medical care. Unemployment, poverty, and their social accompani-
ments are generally associated with less adequate mental and
physical health. The poor, having fewer economic and social
resources, experience higher levels of stress and are more
vulnerable to infectious agents, economic problems, and hazards
in the home and workplace. These problems are typified by
farming. The prolonged decline of economic conditions for many
farmers has increased stress. Pollution from agricultural
chemicals (fertilizers and pesticides) and injuries are relative-
ly common: among all industrial groups, farmers rank near the top
on rates for poisoning, skin diseases, and injuries (12). Also,
rural populations are less likely to have medical insurance
and/or quick access to medical care. In short, economic condi-
tions and environmental factors may interact in complex ways to
affect health status.

Lifestyle refers to behaviors that affect health and over
which individuals have varying degrees of control. There are
substantial data showing that certain health habits (e.g., never
having smoked, moderate or no alcohol consumption, regular
exercise, sleeping 7-8 hours per night, and maintaining appropri-

ate weight) are associated with improved health and reduced mortality (13). Individuals' lifestyle decisions regarding these variables are associated with their socioeconomic status, race, and sex: men are more likely than women to smoke and drink excessively and to exercise; younger women are more likely to smoke than older women; blacks are more likely to be sedentary and to smoke than whites; and black women are substantially overweight almost twice as often as white women. Persons with fewer than 12 years of education are more likely to smoke, sleep excessively, not exercise, and be substantially overweight. (13) In short, individuals' decisions are conditioned to a large extent by their socioeconomic status. "Blaming the victim" by keeping the problem at the individual level may obscure the origins of disease in the socioeconomic environment. However, policies to educate individuals about their health behaviors are much less complex and easier to sell politically than those aimed at modifying the underlying social and economic determinants of lifestyle and health.

This is not meant to suggest that health education is without impact. Certain population groups are more likely to have lifestyles associated with increased mortality, and education programs are effective (although short-run) complements to policies oriented toward the environmental factors that condition lifestyle. For example, nutrition education can have a substantial health payoff among the poor, but only if they are provided sufficient money to buy proper foods and facilities for preparation. Sex education for prevention of sexually transmitted diseases and unwanted pregnancies is another area where education may be very effective in altering specific high-risk behaviors that are or may be associated with lifestyle. Variables such as income, education, and residence (urban versus rural) may be important indicators and determinants of lifestyle (14), and effective education programs must consider variations along such dimensions. In short, targeting specific groups is likely to be

more successful than generalized education or media campaigns.

Biological factors are relatively powerful determinants of mortality. The age, race, and sex of an individual are biologically determined, and mortality rates vary consistently along these dimensions: health is strongly tied to aging and the life cycle. Some diseases that vary by race are thought to be genetically linked, and biological factors account for some of the differences in incidence rates between males and females for some diseases, with females living longer on the average. However, there are health consequences of age, race, and sex that are not biological in origin. Social stratification is partly based on these variables, with the elderly, nonwhites, and females generally being accorded lower socioeconomic status. Some of the elevated male mortality may result from the aggressive, achievement-oriented lifestyle that accompanies higher status positions (15), while higher nonwhite mortality is due in part to a lower position in the economic hierarchy (16).

Many causes of diseases are directly or indirectly genetic in origin. In North Carolina, an estimated 320,375 persons are afflicted with serious genetic disorders, resulting in physical defects, mental retardation, and other health problems, and approximately 80 percent of birth defects are genetic in origin (17). Forty percent of the children admitted to inpatient pediatric care are there because of genetic disorders (18), and about 50 percent of all childhood blindness is linked to genetic factors (19). In North Carolina, congenital malformations are now the leading cause of mortality among infants under one year, and second only to injuries among children ages one through four (20). Overall, the 1988 congenital anomalies death rate was 5.3 deaths per 100,000 population. In addition, some persons have a genetically linked susceptibility to certain diseases. Some types of cancer, for example, may result from genetic weaknesses of the immunological system in combination with specific external

agents (carcinogens).

The medical care system is another important determinant of mortality levels. This complex system is primarily reactive, in that it responds to health problems by attempting to restore the individual to a full and productive life. Disease prevention is also within the purview of the medical care system, as exemplified by vaccination to prevent infectious diseases and by patient education concerning specific health consequences of certain behaviors. Medical care personnel may occasionally be involved in attacking certain environmental and biological causes of disease, though this type of activity has traditionally been carried out by the public sector.

McKeown and Brown (21) present evidence suggesting that medical practice in the first half of the 19th century had little to do with the large decline in mortality that took place in Western societies, but rather that transportation improvements, changes in the economic system that assured a more continuous and nutritious food supply, and improved sanitation practices urged on by reformers in the cities were responsible. After the practice of antisepsis became widespread late in the 19th century, medical care became a much more positive factor in reducing mortality. During the first half of this century, the health and average life span of Americans improved considerably, due substantially to efforts in the medical sector to reduce infections and acute nutritional diseases. Major gains were also observed in infant and maternal mortality, probably due to improvements in nutrition, sanitation, and the development of vaccines (22). However, McKeown (23) notes that a significant reduction in mortality from the introduction of antibiotics cannot be demonstrated.

Medical care may sometimes have negative health consequences. It has been estimated that nosocomial infections (acquired inside

the hospital) strike five percent of Americans hospitalized each year, adding to hospital costs by increasing lengths of stay (24). Inappropriate or unnecessary treatment may also increase mortality as well as health care costs. Probably less than 20 percent of the procedures used by health professionals have been demonstrated to be helpful in clinical trials (25). In short, risks are always present, even in proper medical treatment, but in most cases they are far outweighed by the potential benefits.

In summary, a complete program to improve health status and reduce mortality must include environmental, lifestyle, biological, and medical care strategies. Too much emphasis in one area may involve substantial opportunity costs due to neglect of other areas. For example, expenditures for basic research, for environmental protection, to improve substandard housing, or for public education regarding specific risk behaviors could have higher long-term health payoffs than would the same amount expended just for medical care. The status of heart disease and cancer as major killers is closely linked to environmental and lifestyle factors, and medical treatment or attempts to modify individual behaviors are unlikely to substantially reduce mortality from these diseases. Increased per capita consumption of foods high in animal fats along with the increase in sedentary occupations, and drinking and smoking associated with stresses on the individual and family unit all underlie both heart disease and cancer. In addition, the spiral of post-WWII economic production, technological achievements, and personal affluence have led to chronic exposure of large segments of the population to increasing numbers of carcinogens in the air, water, and food supplies. Cancer control is such a difficult policy area precisely because cancer prevention will require fundamental changes in the physical--and therefore economic--environment, as well as modification of behaviors and lifestyle. Policies aimed at improving the medical treatment of cancer patients, while often costly, are probably easier to implement, but they do not con-

front the basic problems. In brief, strategies to deal with cancer, heart disease, and other leading causes of mortality must deal with factors that exist in the fabric of contemporary society.

RISK FACTORS

Risk factors particular to each cause of death are discussed in separate sections of this volume. In addition, information about several factors that are common to a number of different causes of death is summarized here.

Two of the most pervasive factors contributing to U.S. mortality from various diseases are high blood pressure and cigarette smoking. Elevated blood pressure is associated with death from all cardiovascular diseases, diabetes mellitus, cirrhosis of the liver (26, 27) and renal failure (28). While most causes of hypertension are amenable to treatment, many people either are unaware of having the condition or do not modify behaviors (e.g., maintain proper weight, diet, and medication regimen) necessary to control it.

Use of tobacco products contributes to death from a large number of causes (26, 27, 29-32). According to data compiled by the U.S. Surgeon General (32), cigarette smoking is a major cause of lung cancer as well as cancers of the larynx, oral cavity, and esophagus; it is a contributory factor in the development of cancers of the bladder, pancreas, and kidney; and approximately 30 percent of all cancer deaths are attributable to cigarette smoking. There is evidence that it is a contributor in the development of chronic bronchitis and emphysema, pulmonary heart disease, myocardial infarction, aortic aneurysm, and a wide variety of other vascular diseases. It may be a risk factor for Alzheimer's Disease (33). In addition, smoking seems to interact synergistically with other risk factors, such as asbestos, ioniz-

ing radiation, oral contraceptives, and certain dietary factors, to produce a variety of cancers and vascular diseases. While the low tar, low nicotine cigarette may be less likely to cause lung cancer or chronic bronchitis, its carbon monoxide content--which is associated with vascular disease--remains unchanged. The increased use of smokeless tobacco (snuff, chewing tobacco, and similar products) is disturbing, since these products are associated with tongue cancer mortality and oral cancers in general (34, 35). Finally, the impact of tobacco use on mortality is such that nearly 50 percent of the difference by sex in total mortality over the adult age span is likely attributable to smoking (36). The data indicate that a considerable reduction in morbidity and mortality related to tobacco usage is likely to come about only with a substantial reduction in usage of tobacco products (29).

Diet also has an important impact on certain causes of mortality. Overeating may lead to obesity, which is associated with high blood pressure, diabetes, and cardiovascular disease. In turn, diabetes is a risk factor for stroke and other cardiovascular diseases. In addition, the content of the modern diet has important consequences for mortality. The contemporary diet " . . . is higher in intake of energy, of protein (especially animal protein), and of fat (especially animal fat), but lower in intake of fiber-containing cereal foods; this diet is associated with high rates of morbidity and mortality from degenerative diseases" (37). Based on findings such as these, decreased intake of animal fat and protein, cholesterol, salt, sugar, and alcohol are often--but not unanimously--recommended.

Excessive alcohol consumption is the third largest health problem in America (38) and is associated with a risk of premature death greatly exceeding normal expectancy from a variety of diseases (39-41). "While the lifestyle typical of many heavy drinkers contributes to this risk, the effects of alcohol per se

account for a substantial part of the excess mortality" (39). In two Chicago studies, heavy drinkers had higher mortality from all causes, cardiovascular diseases, coronary heart disease, and sudden death than could be entirely explained by other risk factors such as blood pressure, smoking, and weight (40). Heavy alcohol use by pregnant women leads to birth anomalies, including fetal alcohol syndrome and subsequent mental retardation (38). In contrast to findings for excessive alcohol consumption, the mortality experience of moderate drinkers does not seem to differ notably from that of life-long abstainers (39).

Social class has a very strong impact on mortality (16, 30, 42). "Social class gradients of mortality and life expectancy have been observed for centuries, and a vast body of evidence has shown consistently that those in the lower classes have higher mortality, morbidity, and disability rates" (16). The higher morbidity rates typically found in lower socioeconomic status groups indicate that the excess mortality is not simply attribut-able to a higher case fatality rate, since it is accompanied by a higher prevalence of morbidity. Differences between white and nonwhite mortality rates can be attributed largely to social class differences: persons in lower socioeconomic groups, who are substantially nonwhite, live in a more toxic, hazardous, and non-hygienic environment resulting in a broad array of disease consequences. Low education contributes to poor health practic-es, and low income affects many aspects of health, including nutrition. Higher stress levels and ineffective responses to stress also contribute to higher mortality among the poor (16). Lower class persons generally receive less adequate medical care, though this probably does not account for a major portion of the social class differences in morbidity and mortality (16). In fact, the association between excess mortality and low socioeco-nomic status persists independent of individual behaviors or at-tributes such as smoking, alcohol consumption, body mass index, physical activity, martial status, race, and sex; hence the " ...

properties of the sociophysical environment may be important contributors to the . . . excess mortality" (43).

Sex is another important variable associated with mortality. Females have lower mortality rates and greater life expectancies than males in all developed countries (36). The differential in death rates is present at conception and continues for every age group. At birth, the ratio of males to females is 104:100, but by age 70 females outnumber males by approximately 3:2. In the United States, the 1987 age-adjusted death rate for males exceeded that of females by 73 percent (3).

A substantial amount of excess male mortality is related to sex differences in behavior, such as cigarette smoking, drinking alcohol, aggressive competitiveness, and occupational exposure to environmental and physical hazards (15). For 15-44-year-olds, more than 90 percent of the excess male mortality may be attributable to violence and smoking (36). Biological factors also contribute to higher male mortality. "Thus, even among nonsmokers, men have higher mortality than women for certain types of cancer, and this implies that there must be other factors, in addition to smoking, that contribute to higher cancer among men" (36).

To the extent that the sex difference in mortality is not due to biological factors, substantial reductions in male excess mortality may be possible through lifestyle and behavioral changes. With the transition earlier in this century from infectious to degenerative diseases as the major causes of death, lifestyle became more important in affecting mortality experience, and the difference between male and female mortality rates increased steadily. More recently, female mortality relative to male mortality has actually worsened for several age groups and for several leading causes (44). This may be associated with increased smoking (29) and the adoption of other "male" behaviors

by women as job participation and mobility increase and tradi-
tional roles are modified. Thus, social and lifestyle changes
may also help to reduce female mortality.

A number of risk factors have been reviewed that bear on many
causes of death, and efforts to reduce excess mortality must
involve consideration of these important precursors.

NORTH CAROLINA MORTALITY HIGHLIGHTS

o As shown in Table 1, a total of 57,630 North Carolinians died
   in 1988, for a rate of 8.9 deaths per 1,000 population. The
   1988 crude rate was three percent above the 1987 rate. The
   five-year (1984-88) crude rate was 8.6, which was four
   percent over the rate for the 1979-83 period. The median age
   at death in 1988 increased to 72.9 years, up from 72.6 in
   1987 and consistent with a generally steady increase in the
   median over the last three decades.

o The number of deaths per 1,000 population was slightly (under
   2%) higher for nonwhites than for whites, and substantially
   higher for males than for females (by 21%). A much younger
   age structure for nonwhites accounts for the fact that their
   crude mortality rate is not higher in comparison for whites.
   Age-adjusted mortality is much higher for nonwhites.

o Age-adjusted mortality rates for the 1984-88 period show wide
   gaps in the overall risk of mortality by race and sex. In
   the 1984-88 period, the male rate for both races was approxi-
   mately 90 percent greater than the female rate, and the
   nonwhite rate for both sexes remained more than 45 percent
   above the white rate.

o Comparisons of the 1987 N.C. age-race-sex-specific mortality
   rates with corresponding rates for the U.S. (3) reveal the

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following major excesses* in North Carolina:

White males: Under 1 and ages 65-74 (11% above the U.S.
                 rate);

White females: Under 1 (17% above U.S. rate);

Nonwhite males: Ages 1-4 (50%), 5-14 (36%), 45-54 (29%),
                 55-64 (26%), 65-74 (27%), 75-84 (16%);

Nonwhite females: Ages 45-54 (18%)

o   Even after adjusting for age, race, and sex, the eastern
    counties, especially the northeastern counties, seem to have
    consistently higher mortality rates. Based on the 1984-88
    adjusted rates, statistically significant spatial clusters
    exist in the eastern third of North Carolina for total
    mortality, chronic obstructive pulmonary disease, total
    cancer, colon cancer, and cerebrovascular disease. For the
    1984-88 period, the highest overall adjusted death rate was
    in DHR Region IV (the Eastern region).

o   The ten leading causes of deaths in 1988 were (in descending
    order) heart disease, cancer, cerebrovascular disease,
    unintentional injuries, chronic obstructive pulmonary
    disease, pneumonia/influenza, diabetes, suicide, chronic
    liver disease/cirrhosis, and homicide. However, based on
    the number of years of life lost prematurely for each cause,
    the order of the ten leading causes shifts to cancer, heart
    disease, unintentional injuries, suicide, homicide,
    cerebrovascular disease, chronic obstructive pulmonary

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*North Carolina excesses for nonwhites reflect to some
extent the fact that the proportion of blacks in the N.C.
nonwhite population is greater than for the U.S., and mortality
rates for black males and females in each age group generally
exceed the corresponding nonwhite rates.

disease, chronic liver disease/cirrhosis, diabetes, and pneumonia/influenza.

o   Nonwhite males have a greater risk of death from unintentional injuries at every age interval except 15-24 and 85 and older where white males have the highest rates. The 1988 age-adjusted nonwhite male rates for motor vehicle and all other unintentional injuries exceeded rates for white males by 47 and 124 percent respectively.

o   Comparing the U.S. and N.C. 1987 unadjusted rates, mortality in N.C. was more than 23 percent greater for unintentional injuries and septicemia, 14 percent greater for cerebrovascular disease, and five percent greater for homicide. However, for most remaining leading causes including cancer and diseases of the heart, the N.C. unadjusted rates were two to 20 percent lower than the corresponding U.S. rates. Total mortality for N.C. was one percent lower than for the U.S. After adjusting for the state's more youthful age structure, mortality conditions in N.C. appear less favorable, especially for cerebrovascular disease, unintentional injuries, and septicemia. The adjusted total mortality rate for N.C. was nearly six percent greater than for the U.S.

o   The 1988 total cancer rate was three percent above the rate for 1987. Site-specific cancers showing large percentage increases in rates for 1988 were leukemia (+10%) and cancer of the pancreas (+8%). Of the four major cancers, rates for three (trachea/bronchus/lung; breast; and prostate) each increased by about six percent while cancer of the colon/rectum/anus increased approximately two percent. Cancer of the cervix uteri and stomach cancer each decreased by about three percent. However, some of these increases

reflect aging of the state's population. After adjusting for age, the increase in the total cancer rate between 1987 and 1988 dropped to one percent; the rate for cancer of the colon/rectum/anus decreased by three percent; the rate for breast cancer was essentially unchanged; and rates for cancer of the trachea/bronchus/lung and prostrate cancer showed four percent increases. By race and sex, the 1988 age-adjusted rates for males were substantially higher than those for females, and rates for nonwhites were higher than those for whites.

Total cancer mortality (the unadjusted rate) increased steadily (by 19 percent in total) between 1980 and 1988 and rose 10 percent during the 1984-88 five-year period in comparison to the 1979-83 period. Further comparisons of the five-year periods show that unadjusted rates for cancer of the trachea/bronchus/lung and breast cancer each increased by about 20 percent, and prostrate cancer and cancer of the ovary and other uterine adnexa both increased by 13 percent. The rate for cancer of the cervix uteri decreased by 10 percent, while leukemia and stomach cancer rates decreased by two percent. Comparisons based on age-adjusted rates show that total cancer increased by two percent, while cancer of the trachea/bronchus/lung and breast increased by 12 percent and 11 percent respectively.

o   Between the 1979-83 and 1984-88 five-year periods, the pneumonia/influenza and chronic obstructive pulmonary disease (COPD) crude death rates in N.C. increased 26 and 28 percent respectively. For both causes, large crude rate increases over the last five years occurred between 1987 and 1988. After adjusting for age, the mortality rate for pneumonia/influenza shows a relatively moderate increase of eight percent between the 1979-83 and 1984-88 periods, whereas the corresponding increase for COPD was more

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substantial (about 15 percent). Based on 1987 age-adjusted rates, North Carolina's rates for COPD and pneumonia/influenza are about six percent and one percent respectively less than corresponding U.S. rates (3). Race-sex-specific age-adjusted rates show that males of both races die from each of these causes substantially more often than females. COPD mortality rates for whites are higher than for nonwhites, while nonwhites have higher rates from pneumonia/influenza.

o   The suicide crude death rate decreased slightly in four of the last five years. In 1988, the rate fell by less than two percent, to slightly below the 1987 U.S. rate. Between the 1979-83 and 1984-88 periods, the age-adjusted suicide rate remained essentially stable. Based on 1984-88 age-adjusted data, the rate for white males is approximately twice that of nonwhite males and nearly three times that of white females, while nonwhite females have an age-adjusted rate less than half that of white females.

o   The homicide crude death rate increased from 1984 to 1986, then decreased in 1987 and 1988. For the five-year period 1984-88, the rate was 16 percent lower than for the preceding five years (1979-83), although it was above the U.S. rate for 9 of the 10 years between 1979 and 1988. Between 1987 and 1988, the age-adjusted homicide rate declined about 11 percent for whites and increased five percent for nonwhites of both sexes. In 1988 about 40 percent of all homicide victims were nonwhite males; yet nonwhite males represent only 11 percent of the total population. The age-adjusted homicide rate for nonwhite males exceeded that for white males by 327 percent.

Since 1914, when deaths were first centrally recorded in North Carolina, the leading causes of mortality have been ranked according to number of deaths. North Carolina deaths in 1988 have been ranked in Table A for each race-sex group based on this traditional method. As shown, heart disease and cancer are the leading causes of death for each group, unintentional injuries are the third leading cause for white and nonwhite males, and stroke (cerebrovascular disease) is the third leading cause for white and nonwhite females. The rankings of most causes, as well as the sizes of the rates for the same cause, vary among the four groups.

Rankings based only on number of deaths (or rate per 100,000 population), however, do not necessarily indicate where medical and public health intervention strategies can be most effectively employed. Since death is postponable but not preventable, age at death is a key factor to consider. Prevention of a death that would otherwise occur early in life could be assigned higher priority than prevention of a death later in life. A convenient method of ranking causes of death that incorporates age at death is by "years of life lost" (7). If the average life expectancy at birth for white males, for example, is 70 years, a death at age 65 would mean five years of life lost (on the average), while a death at age 40 would mean 30 life-years lost. A white male infant death results in 70 years of life lost, whereas deaths at ages 70 and over do not contribute to "life-years lost" for white males. Based on the 1990 life tables for North Carolina (43), the life expectancies used here to calculate years of life lost were 72 for white males, 80 for white females, 67 for nonwhite males, and 76 for nonwhite females. For each death in a given cause group, age at death was subtracted from the appropriate life expectancy and all of these life-years lost were then summed for that race-sex group. Deaths over the specified life

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expectancies were not counted. A rate of years-of-life-lost per 100,000 population was then computed for ranking the causes of death, so that comparisons can be made across race-sex groups. These rates are given in Table B.

A more accurate determination of years of life lost is based on an average expected remaining years of life for each age of death rather than an average life expectancy at birth. This procedure was considered too complicated for the present application, and probably would not produce rankings substantially different from those in Table B. It would place somewhat less emphasis on infant mortality, since more years of life lost would be generated for the causes listed in Table B.

Table B displays the leading causes of death ranked according to years of life lost per 100,000 population. Heart disease and cancer are still very important causes of death from this perspective, but other causes become much more prominent than before. Unintentional injuries (motor vehicle injuries and other injuries combined) account for more than twice as many years of life lost for nonwhite males than any other cause except heart disease, and were also the top-ranked cause for white males. The general seriousness of injuries as a life and health hazard is clearly shown in this table. Unintentional injuries become a much more important cause of death relative to heart disease from this perspective, since injury decedents (who died prior to normal life expectancy) are on average about 28 years younger than heart disease decedents. Likewise, cancer decedents who die prior to normal life expectancy are on average more than two years younger than heart disease decedents. Cancer accounts for the most years of life lost among white women and in total, in part because the life expectancy for white women is substantially longer than for any other race-sex group.

TABLE A

1988 North Carolina Leading Causes of Mortality Ranked by Death Rate (Deaths per 100,000 Population) for Race-Sex Groups (Based on Underlying Cause of Death)

TOTAL	WHITE MALES	WHITE FEMALES	NONWHITE MALES	NONWHITE FEMALES
Heart Disease 299.4	Heart Disease 339.0	Heart Disease 280.6	Heart Disease 294.7	Heart Disease 246.9
Cancer 195.8	Cancer 222.9	Cancer 179.8	Cancer 226.6	Cancer 139.5
Cerebrovascular Disease 73.7	Unintentional Injuries 60.9	Cerebrovascular Disease 85.4	Unintentional Injuries 97.0	Cerebrovascular Disease 85.6
Unintentional Injuries 49.5	Cerebrovascular Disease 57.3	Pneumonia and Influenza 32.9	Cerebrovascular Disease 73.0	Diabetes Mellitus 37.0
Chronic Lung Disease 32.3	Chronic Lung Disease 46.7	Unintentional Injuries 31.5	Homicide 31.8	Unintentional Injuries 30.1
Pneumonia and Influenza 29.8	Pneumonia and Influenza 30.7	Chronic Lung Disease 28.5	Pneumonia and Influenza 29.5	Pneumonia and Influenza 17.8
Diabetes Mellitus 20.4	Suicide 23.4	Diabetes Mellitus 19.1	Chronic Lung Disease 27.6	Chronic Liver Disease 12.1
Suicide 12.08	Diabetes Mellitus 15.2	Septicemia 9.5	Diabetes Mellitus 23.2	Septicemia 10.9
Chronic Liver Disease 10.8	Chronic Liver Disease 13.1	Atherosclerosis 7.5	Chronic Liver Disease 17.0	Kidney Disease 10.8
Homicide 8.9	Homicide 8.0	Chronic Liver Disease 6.4	Kidney Disease 12.1	Homicide 10.2
Septicemia 8.2	Kidney Disease 5.7	Kidney Disease 6.1	Suicide 10.5	Atherosclerosis 7.5
Kidney Disease 7.2	Septicemia 5.3	Suicide 5.2	Septicemia 10.1	Chronic Lung Disease 7.3
Artherosclerosis 6.4	Atherosclerosis 4.6	Homicide 4.6	Atherosclerosis 2.7	Suicide 2.0

TABLE B

1988 North Carolina Leading Causes of Mortality Ranked by Years of Life Lost per 100,000 Population for Race-Sex Groups (Based on Underlying Cause of Death)

TOTAL	WHITE MALES	WHITE FEMALES	NONWHITE MALES	NONWHITE FEMALES
Cancer 1,813	Unintentional Injuries 1,926	Cancer 2,329	Unintentional Injuries 2,824	Heart Disease 1,582
Heart Disease 1,598	Heart Disease 1,840	Heart Disease 1,391	Heart Disease 1,542	Cancer 1,571
Unintentional Injuries 1,507	Cancer 1,545	Unintentional Injuries 873	Cancer 1,182	Unintentional Injuries 1,070
Suicide 339	Suicide 602	Stroke 337	Homicide 1,046	Stroke 539
Homicide 325	Homicide 278	Chronic Lung Disease 255	Stroke 368	Homicide 466
Stroke 308	Chronic Liver Disease 179	Suicide 182	Suicide 319	Diabetes Mellitus 292
Chronic Lung Disease 183	Stroke 178	Diabetes Mellitus 178	Chronic Liver Disease 296	Chronic Liver Disease 277
Chronic Liver Disease 174	Chronic Lung Disease 152	Pneumonia and Influenza 152	Pneumonia and Influenza 243	Pneumonia and Influenza 167
Diabetes Mellitus 165	Pneumonia and Influenza 124	Homicide 124	Diabetes Mellitus 158	Chronic Lung Disease 115
Pneumonia and Influenza 139	Diabetes Mellitus 120	Chronic Liver Disease 120	Chronic Lung Disease 116	Septicemia 106
Septicemia 65	Septicemia 32	Septicemia 82	Kidney Disease 89	Kidney Disease 96
Kidney Disease 50	Kidney Disease 30	Kidney Disease 43	Septicemia 69	Suicide 81
Artherosclerosis 10	Atherosclerosis 8	Atherosclerosis 9	Atherosclerosis 19	Atherosclerosis 10

REFERENCES FOR SECTION I

1. United States Department of Health, Education, and Welfare. Public Health Service, National Vital Statistics Division. Vital Statistics of the United States, Volume II-Mortality (Part A). Washington, 1960, 1970.

2. U.S. Department of Health and Human Services. Public Health Service, National Center for Health Statistics. Vital Statistics of the United States, Volume II-Mortality (Part A). Washington, 1980.

3. U.S. Department of Health and Human Services. Public Health Service, Centers for Disease Control, National Center for Health Statistics. Vital Statistics of the United States, Volume II-Mortality (Part A). Washington, 1987.

4. International Classification of Diseases, 9th Revision, Volume 1, Diseases: Tabular List, Commission on Professional and Hospital Activities, Ann Arbor, MI, 1980.

5. Grove, R.D.; Hetzel, A.M. Vital Statistics Rates in the United States: 1940-1960. Public Health Service Publication Number 1677, U.S. Government Printing Office, Washington, 1968.

6. SAS Institute Inc. SAS User's Guide: Statistics, 1982 Edition, Cluster Procedure. Cary, N.C.

7. Kleinman, J.C. <u>Statistical Notes for Health Planners: Mortality</u>. Public Health Service Publication Number 1677, U.S. Government Printing Office, Washington, 1968.

8. Lalonde, M.A. <u>A New Perspective on the Health of Canadians</u>. Government of Canada, Ottawa, 1974.

9. North Carolina Department of Human Resources, Division of Health Services, Public Health Statistics Branch. "Associations Between Mortality and Various Social, Economic, and Environmental Factors in North Carolina," <u>PHSB Studies</u>. No. 3, Raleigh, April 1977.

10. Landrigan, P.J. "Comment: The Effects of Ozone Pollution on Our Children." <u>The Nation's Health</u>, Vol. XIX, No. 4, April, 1989, pg. 9.

11. Gannon, I.R., "President's Column," <u>The Nation's Health</u>, Vol. XIX, No. 7, July, 1989, pg. 2.

12. Gannon, I.R., "President's Column," <u>The Nation's Health</u>, Vol. XIX, No. 4, July 1989, pg. 2.

13. Schoenborn, C.A. "Health Habits of U.S. Adults, 1985: the "Alameda 7" Revisited," <u>Public Health Reports</u>, Nov-Dec; Vol 101, No. 6, 1986, pp. 571-580.

14. North Carolina Department of Human Resources, Division of Health Services, Public Health Statistics Branch. "Health Characteristics of Adults in North Carolina," <u>PHSB Studies</u>. No. 11, Raleigh, NC, July 1978.

15. Waldron, I. "Why Do Women Live Longer Than Men?," <u>Social Science and Medicine</u>. Vol. 10, 1976, pp. 349-362.

16. Syme, S.L.; Berkman, L.F. "Social Class, Susceptibility, and Sickness," American Journal of Epidemiology. Vol. 104, No. 1, 1976, pp. 1-8.

17. What Are The Facts about Genetic Disease? The National Institute of General Medical Sciences, The National Institutes of Health, Bethesda, MD, 1980.

18. North Carolina Department of Human Resources, Division of Health Services, Public Health Statistics, North Carolina Vital Statistics: Quarterly Provisional Report. Raleigh, January-March, 1978.

19. Robinson, C.G. "Causes, Occular Disorders, Associated Handicaps, and Incidence and Prevention of Blindness in Childhood," in Visual Impairments in Children and Adolescents, eds. Jan, S.E.; Freeman, R.D.; and Scott, E.P.; Grune & Stratton, New York, 1977.

20. N.C. Department of Human Resources, Division of Health Services, State Center for Health Statistics, "North Carolina Surveillance of Birth Defects." SCHS Studies. No. 52, Raleigh, September 1989.

21. McKeown, T.; Brown, R.G. "Medical Evidence Related to English Population Changes in the Eighteenth Century," Population Studies, No. 9, 1955, pp. 119-141.

22. Jonas, S. Health Care Delivery in the United States. Third Edition, Springer Publishing Company, New York, 1986, pp. 24-25.

23. McKeown, T. The Role of Medicine: Dream, Mirage, or Nemesis. London: The Nuffield Provincial Hospitals Trust, 1976.

24. Cassel, E. Human Ecology and Public Health. Kilbourne and Smillie, Editors, 1969, pg. 353.

25. White, K. Personal communication. 1982, in Jonas, S. Health Care Delivery in the United States. Third Edition, Springer Publishing Company, New York, 1986, pg. 25.

26. Paffenbarger, R.S.; Brand, R.J.; Sholtz, R.I.; Jung, D.L. "Energy Expenditure, Cigarette Smoking, and Blood Pressure Level as Related to Death from Specific Diseases," American Journal of Epidemiology. Vol. 198, No. 1, 1978, pp. 12-18.

27. Eyer, J. "A Diet/Stress Interaction Hypothesis of Coronary Heart Disease Epidemiology," International Journal of Health Services. Vol. 9, No. 1, 1979, pp. 161-168.

28. Manton, K.G.; Patrick, C.H.; and Johnson, K.W. "Health Differences between Blacks and Whites: Recent Trends in Mortality and Morbidity," The Milbank Quarterly. Vol. 65, Suppl. 1, 1987, pp. 129-199.

29. Doll, R. "The Smoking Induced Epidemic," Canadian Journal of Public Health, Vol. 72, November-December, 1981, pp. 372.

30. Curtiss, J.; Grahn, R.B.; Grahn, D. "Population Characteristics and Environmental Factors That Influence Level and Cause of Mortality: A Review," Journal of Environmental Pathology and Toxicology. Vol. 4, No. 2, 1980, pp. 471-511.

31. Doll, R.; Peto, R. "The Causes of Cancer: Quantitative Estimates of Avoidable Risks of Cancer in the U.S. Today," Journal of the National Cancer Institute, 1981.

32. US Department of Health and Human Services, Office on Smoking and Health. <u>The Health Consequences of Smoking: Cancer, A Report of the Surgeon General</u>. Rockville, Md., 1982.

33. Shalat, S.L; B.; Pidcock, C., et. al. "Risk Factors for Alzheimer's Disease: A Case-Control Study," <u>Neurology</u>. Vol. 37 No. 10, October, 1987 pp. 1630-1633.

34. Davis, S.; Severson, R.K. "Increasing Incidence of Cancer of the Tongue in the United States Among Young Adults". (Letter), <u>Lancet</u> 2 (8564), pp. 910-911, October 17, 1987.

35. Connoly, G.N.; Blum, A; Richards, J.W. Smoke Screen Around Oral Snuff. (Letter), <u>Lancet</u> 2 (8551), pg. 160, July 18, 1987.

36. Waldron, I. "The Contribution of Smoking to Sex Differences in Mortality", <u>Public Health Reports</u>, 101(2), March-April 1986, pp. 163-173.

37. Walker, A.R. "Dietary Goals, Sensible Eating, and Nutrition in the Future," <u>South African Medical Journal</u>. Vol 57, No. 4, 1980, pp. 471-511.

38. West, L.J.; Maxwell, D.S.; Noble, E.P.; Solomon, D.H., "Alcoholism." <u>Annals of Internal Medicine</u>. Vol. 100, 1984, pp. 405-416.

39. Schmidt, W.; Popham, R.E. "Heavy Alcohol Consumption and Physician Health Problems: A Review of Epidemiological Evidence," <u>Drug and Alcohol Dependence</u>, Vol. 1, No. 1, 1975, pp. 27-50.

40. Dyer, A.R.; et al. "Alcohol Consumption, Cardiovascular Risk Factors, and Mortality in Two Chicago Epidemiologic Studies," Circulation. Vol. 56, No. 6, December, 1977, pp. 1067-1074.

41. Buescher, P.A.; Patetta, M.J., "Alcohol-Related Morbidity and Mortality in North Carolina." SCHS Studies. N.C. Department of Human Resources, Division of Health Services, State Center for Health Statistics, No. 41, July, 1986.

42. Egbuonu, L. "Child Health and Social Status," Pediatrics. Vol. 69, No. 5, 1982, pp. 550-557.

43. Haan, M.; Kaplan, G.A.; Camacho, T. "Poverty and Health: Prospective Evidence from the Alameda County Study." American Journal of Epidemiology, Vol. 125, No. 5, June, 1987, pp. 989-998.

44. Verbrugge, L.M. "Recent Trends in Sex Mortality Differentials in the United States," Women and Health, Vol. 5, No. 3, 1980, pp. 17-37.

II. TECHNICAL NOTES

NORTH CAROLINA POPULATION BASES

Every ten years (years ending in zero) the United States Bureau of the Census has conducted a count of the United States population, which includes a profile of the population's characteristics such as age, race, and sex. After a census year, estimates of population size and composition are based on knowledge of the population in the census year plus subsequent events such as births, deaths, and migration. In the later years of a decade, these estimates may depart considerably from the "true" population values if the assumptions about population changes differ significantly from what actually occurred. Since almost all mortality rates in CHES publications are based on population counts in the denominator, changes in estimates of population such as might result from a new census could cause substantial changes in the trend of rates over time.

State and county population bases are obtained from the North Carolina Office of State Budget and Management, and incorporate assumptions about births, deaths, net migration, and institutional populations (1). In this volume the reader should note that pre-1988 rates have been corrected for changes in population bases in order to interpret trends. These corrected rates may differ slightly from the rates shown in previous CHES publications.

MORTALITY RATES

COMPUTATION OF MORTALITY RATES

In this report, total death rates are expressed as resident deaths per 1,000 population while all cause-specific mortality rates are expressed as resident deaths per 100,000 population. All rates in Tables 1-20 use total population in the denominator, except rates for the sex-specific cancer sites, which use male or female population in the denominator. Population bases for these rates were provided by the Office of State Budget and Management in the Governor's Office. The infant mortality rates of Table 21 and Figure 17 are computed as the number of resident deaths under one year of age per 1,000 resident live births.

Vital events in this report are allocated to place of residence. For deaths of inmates of long-term institutions (mental, penal, old age, orphan, nursing home, rest home, etc.), the institution is considered the usual residence provided the decedent had resided in the institution at least one year. College students and military personnel are considered residents of the college or military community.

The following definitions apply to the rates of Tables 2-20.

> **Unadjusted Annual Death Rate:** the annual death rate computed as resident deaths per 1,000 or 100,000 population. These rates permit the user knowledge of an area's status with respect to the observed incidence of mortality during the given year.

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Unadjusted 5-Year Death Rate: the average annual death rate computed as average resident deaths per 1,000 or 100,000 average population. These rates permit the user knowledge of an area's status with respect to the observed incidence of mortality during the 5-year period. These rates are depicted in the Series A maps (e.g., Figures 2.A, 3.A, etc.).

Adjusted 5-Year Death Rate: the average annual age-race-sex-adjusted rates computed by the direct method. Also expressed as deaths per 1,000 or 100,000 population, these rates are those which would be expected if the average annual age, race, and sex composition of each county's population were the same as that estimated for the state. These rates are free of differing effects of age, race, and sex and thus permit the user knowledge of an area's status with respect to other determinants of mortality during the 5-year period. Adjusted rates for different time periods cannot be directly compared unless they were adjusted by the same standard population. The adjusted rates are depicted in the Series B maps (e.g., Figures 2.B, 3.B, etc). [Note: For the two sex-specific cancer sites (female breast and prostate), rates are adjusted for age and race and denominators are sex-specific.]

Except as noted in the text of this report, the age-adjusted death rates cited in the narrative (not the age-race-sex adjusted rate in tables 2-20) use the 1940 U.S. Census as the standard for direct age-adjustment, following the convention of the National Center for Health Statistics. The use of this standard is necessary for comparison of N.C. and U.S. age-adjusted rates.

For the maps, a clustering routine* from the Statistical Analysis System (SAS) was used to group counties that are "most like each other" with respect to their unadjusted rates and then their adjusted rates (2). These maps show six levels of death rates, where level one is the lowest rate interval and level six the highest.

INTERPRETATION OF MORTALITY RATES

To assess an area's relative mortality conditions during a five-year period, both the unadjusted rate and the adjusted rate can be compared to the state rate for a particular cause of death. Then, provided the area's unadjusted rate represents a relatively stable situation, viz., the rate has not fluctuated widely in recent years, the following alternative diagnoses will apply:

Relative Status Of		
Unadjusted Rate	Adjusted Rate	Diagnosis
Low	Low	Low mortality is not due to age, race, and sex factors; other mortality conditions are favorable.

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*In 1983 the CHES conducted an evaluation of several clustering methods. It was found that one method, called "Average Linkage Method," produced tighter clusters (i.e., clusters with smaller within-cluster variances) than the other methods examined. Consequently, we have used this method henceforth to cluster county rates in all CHES publications.

	Relative Status Of	
Unadjusted	Adjusted	
Rate	Rate	Diagnosis
Low	High	Low mortality is due to favorable age, race, and sex factors; other mortality conditions are unfavorable.
High	Low	High mortality is due to unfavorable age, race, and sex factors; other mortality conditions are favorable.
High	High	High mortality is not due to age, race, and sex factors; other mortality conditions are unfavorable.

In using adjusted rates, it is important that the user understand the reason for adjustment. The following hypothetical example illustrates. Here, A and B stand for population sub-groups, e.g., whites and nonwhites, males and females, etc.

	COUNTY			STATE		
	POPULATION	DEATHS	DEATH RATE*	POPULATION	DEATHS	DEATH RATE*
Population A	300,000	1,000	333.3	500,000	2,500	500.0
Population B	10,000	10	100.0	800,000	1,000	125.0
Total	310,000	1,010	325.8	1,300,000	3,500	269.2

*Deaths per 100,000 population.

Compared to the state, county subgroups A and B both have lower rates, but the county as a whole (A and B combined) has a higher rate. This seemingly paradoxical situation results from two factors: different proportions of A and B in the county vs.

the state population and wide differences between the rates for A vs. B. In this example, it is true that the county has a higher total rate--BUT ONLY BECAUSE THE POPULATION CONTAINS A HIGH PROPORTION OF SUBGROUP A.

Certainly, it is important for program planners to know that the county has a high rate relative to the state rate; this information is needed in determining manpower and facility needs, etc. But in assessing "risk," the researcher needs to adjust for confounding factors such as age or race. To do this, one multiplies each population-specific county rate by the corresponding "standard" population, sums these results, and divides by the total "standard." In the above example, using the state population as the standard, the computation is:

$$\frac{(1,000/300,000 \times 500,000) + (10/10,000 \times 800,000)}{1,300,000} = 0.001897 \text{ or } \frac{189.7 \text{ per}}{100,000 \text{ population}}$$

Thus, as rates specific for A and B imply, the county's rate is <u>lower</u> than the state's rate after adjustment for the factor represented by A and B.

CAUTION!

In assessing the relative mortality conditions of a county, one should be particularly aware of rates based on small numbers of deaths since, in such cases, random fluctuation in the rate may render rate comparisons risky. The reader should read very carefully the next section entitled "Flagging Biased Rates."

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FLAGGING BIASED RATES

This section discusses the problem of unstable mortality
rates and then describes a method of flagging rates with a large
bias in a given year. The reason for flagging an unstable or
possibly biased rate is to provide the reader with a criterion
for placing confidence in statements, tables, maps, and other
interpretative displays of the mortality data. Not all calcu-
lated rates are an accurate portrayal of the "true" force of
mortality, and the intent of this section is to caution the
reader against uncritically using the rates in this volume.
Especially in the maps, the reader should be alert to unusually
high rates that may result from very small numerators or from the
type of bias described below.

Any rate with a small number of events (deaths) in the
numerator will be unstable, with possibly large random fluctua-
tions from year to year that do not comprise a significant trend.
Such a rate is said to have a large standard error. A useful
rule is that any rate based on fewer than 20 events in the
numerator may have a 95 percent confidence interval that is wider
than the rate itself (3). For example, in an area with 20 deaths
out of 20,000 population, the measured rate, stated as deaths per
100,000 population, would be 100. But due to variability over
time in rates based on small numerators, one could say with 95
percent certainty that the underlying or "true" rate (of which
the sample rate of 100 is the best estimate) is between approxi-
mately 50 and 150 deaths per 100,000. The width of the interval
(100) is relatively large because rates based on small numerators
may differ considerably from the actual or "true" rate. Many of
the rates in this volume have numerators smaller than 20 and thus
a large standard error, and any conclusions about trends based on
these rates should be made very cautiously, if at all.

The age-race-sex-adjusted rates in this volume, described in

the previous section, are likewise subject to random variability over time, and those rates involving a small number of deaths will be the most unstable. For example, one death out of an estimated population of 5 would produce a death rate of 20,000 per 100,000 population. If this rate were applied to the appropriate age-race-sex group of the standard population, a very large number of expected deaths would result and the adjusted rate would be biased.

Counties with a small number of persons in one or more of the 40 age-race-sex groups are most likely to have adjusted rates with a large standard error, and these rates therefore show substantial random fluctuation over time. In this volume an adjusted rate is flagged if: a) applying the age-race-sex-specific rates of a county for a given cause to the standard population results in more than 25 percent of the total expected deaths being generated by one cell, and b) the denominator of the rate is also less than 50 (an average of 10 per year). These criteria will catch only the worst problems. Only 21 out of a total of 1900 county adjusted rates in this volume are flagged by this method.

In addition to putting asterisks by those 1984-88 adjusted rates with a large bias due to an extremely high age-race-sex-specific rate, the rates have been recomputed by substituting the appropriate North Carolina age-race-sex-cause-specific rate in the problem cell. Table C on the next page compares the flagged rates with the rates where the state rate has been substituted. The reader who must use one of these flagged rates is advised to use the rate in this table with the substitution instead. If the latter rate is clearly out of line with the North Carolina rate in the last column, the rate should be treated as missing data.

TABLE C

1984-88 Age-Race-Sex Adjusted Death Rates: Flagged Rates and Rate after Substitution of State Rate in Problem Cell

County	Cause	Problem Cell	Numerator	Denominator	Flagged Rate	Adjusted Rate With Substitution	N.C. Rate For Cause
Alleghany	Lung Cancer	NWM 55-64	1	34	68.87	50.04	51.65
Alleghany	Chronic Liver Disease	NWF 55-64	1	40	28.90	4.25	10.01
Alleghany	Septicemia	NWF 75-84	1	39	15.70	5.85	8.92
Ashe	Cancer of Colon, etc.	NWM 75-84	1	27	17.95	9.85	19.61
Ashe	Diabetes	NWF 75-84	1	24	26.21	10.34	15.92
Avery	Cancer of Colon, etc.	NWF 65-74	1	23	49.03	15.48	19.61
Avery	Chronic Liver Disease	NWM 55-64	1	48	26.52	11.85	10.01
Avery	Non-Motor-Vehicle Accidents	NWM 85+	1	0	83.10	21.45	23.58
Dare	Nephritis, etc.	NWM 85+	2	17	11.91	4.86	8.34
Graham	Pneumonia and Influenza	NWF 85+	1	5	38.92	12.38	26.98
Graham	Septicemia	NWM 65-74	1	38	21.73	7.92	8.92
Macon	Prostate Cancer	NWM 75-84	2	30	57.77	29.38	24.47
Madison	Cancer	NWM 65-74	3	25	222.40	166.24	183.64
Madison	Lung Cancer	NWF 65-74	1	35	54.74	32.75	51.65
Madison	Prostate Cancer	NWM 65-74	1	25	69.56	28.39	24.47
Madison	Diabetes	NWM 75-84	1	6	53.80	15.63	15.92
Tyrrell	Atherosclerosis	NWF 85+	1	36	3.77	0.38	8.05
Watauga	Pneumonia and Influenza	NWF 85+	1	20	21.78	15.63	26.98
Watauga	Chronic Lung Disease	NWM 75-84	1	26	25.49	17.36	28.07
Yancey	Stroke	NWF 85+	1	5	64.34	39.52	72.47
Yancey	Non-Motor-Vehicle Accidents	NWF 65-74	1	33	44.00	20.37	23.58

PROCEDURE FOR GEOGRAPHIC CLUSTERING OF COUNTIES

In all editions of this report, county rates for each leading cause of mortality have been mapped. As described in the Introduction of this volume, these maps show counties grouped together (in six groups) based on similar rates--in other words, a numerical clustering of rates. From these maps, one might imply "spatial" clustering if counties with high rates happen to be contiguous to each other. However, under this procedure there is no way to know whether this clustering is a statistically significant geographic cluster or an artifact of the SAS clustering procedure (2).

In 1980 the CHES in conjunction with the UNC Department of Biostatistics developed a new statistical procedure for detecting and characterizing spatial clusters. This procedure determines whether apparent geographic clustering of counties with high rates is statistically significant. Only a brief summary of the mechanics of the procedure is presented in this section. For a detailed description, readers should consult the appropriate reference (4) or contact the Center for Health and Environmental Statistics.

Briefly the mechanics of this procedure are as follows:

1. Counties are listed in rank order of their unadjusted or adjusted rates (highest rates first) for each cause of death.

2. For each county listed, cumulative counts are obtained of
    the number of counties and the number of adjacencies in-
    volved between the county and other counties with higher
    rates. Two counties are considered adjacent if they have a
    common nonsalt-water boundary. For some "pairs" of counties
    (in particular, counties which seem to touch only at one
    point on a map), it was difficult to decide whether these
    counties are adjacent. These "troublesome pairs of coun-
    ties" in North Carolina are discussed in the paper refer-
    enced above as are the decisions made with regard to these
    pairs.

3. Finally, a reference table is used to obtain for the cumula-
    tive number of high-rate counties a significance level based
    on the number of adjacencies observed. While a few adjacen-
    cies might be expected to occur randomly, a relatively large
    number of adjacencies will have a low probability of random
    occurrence. In this report, the high-rate counties are said
    to cluster geographically if the probability of such random
    occurrence is .05 or less; maps for a given disease are
    included in the text only if statistically significant
    geographic clusters were found to exist.

    This procedure can result in one or more groups of contigu-
    ous high-rate counties. For some diseases, no clusters of
    this type exist. For some others, one, two or more clusters
    exist. In the latter case, a disease may cluster with high
    rates in one part of the state and with other tiers or
    levels of high rates in other parts of the state. In this
    report each map shows the multi-tiers or levels via differ-
    erent shading schemes to represent the relative levels of
    the high death rates.

    This method is a simple and inexpensive approach for recog-
    nizing mortality patterns of varying intensity in geographi-
    cal areas and for testing for clusters.

REFERENCES FOR SECTION II

1. North Carolina Office of State Budget and Management, Management and Information Services. <u>North Carolina Population Projections: 1988-2010</u>, Raleigh, 1988.

2. SAS Institute Inc. <u>SAS User's Guide: Statistics, 1982 Edition</u>, Cluster Procedure. Cary, N.C. 1982.

3. Kleinman, J.C. "Infant Mortality," <u>Statistical Notes for Health Planners</u>. No. 2, National Center for Health Statistics, Rockville, Md, July, 1976.

4. Grimson, R.C.; Wank, K.C.; & Johnson, P.W.C. "Searching for Hierarchical Clusters of Diseases: Spatial Patterns of Sudden Infant Death Syndrome," <u>Social Science Medicine</u>, Vol. 15D, pp. 287-293, 1981.

III. GENERAL MORTALITY IN NORTH CAROLINA

GENERAL MORTALITY IN NORTH CAROLINA

During 1988 a total of 57,630 North Carolinians died. This number represents an annual death rate of 8.9 resident deaths per 1,000 population, three percent above the rate of 8.6 for 1987, and is the highest rate over the past 10 years. The 1987 rate for the United States (the most recent year for which data are available) was higher at 8.7 (1). The N.C. unadjusted rate rose in six of the last 10 years. The greatest increases occurred during the 1984-88 period, when the overall rate was five percent greater than in the preceding (1979-83) five-year period.

One confounding factor in making comparisons of mortality rates is that age structure of a population, which has an important impact on mortality, may vary among geographic areas and over time. Compared to the nation, North Carolina has a younger but more rapidly aging population. Thus, adjusting the North Carolina and United States mortality rates for age, a higher mortality rate is obtained for N.C. than for the U.S. The 1987 age-adjusted North Carolina rate (5.7) was nearly six percent higher than the age-adjusted United States rate (5.4), illustrating that N.C.'s lower unadjusted rate (in comparison to the U.S.) is due to its favorable age structure (i.e., more people at the young low-risk ages).

While the N.C. trend for unadjusted rates indicates some increase in mortality, examination of age-adjusted rates shows a different pattern. From 1979-83 to 1984-88 the risk of death for North Carolinians actually declined by five percent, from 6.0 to 5.7 per 1,000 population. Over the longer span since 1974-78,

the state's age-adjusted rate declined by 15 percent.

Age, Race, and Sex Groups

Within the general comparisons of mortality noted above, significant subgroup differences are concealed, especially between N.C. and the U.S. For example, while the 1987 unadjusted U.S. rate was higher than that for North Carolina, mortality rates for infants and for age groups 1-4, 5-14, and 45-54 were each more than 10 percent greater than corresponding United States rates. In fact, only two age groups (15-24 and 85 and over) had rates lower than the U.S. rates.

As observed with age, general comparisons can mask variations by race and sex. Looking at North Carolina deaths in the 1984-88 period, the male rate (9.5) exceeded the female rate (7.7) by 23 percent. For the previous five-year period (1979-83), the male rate was 34 percent greater than the female rate; hence differences in mortality by sex have diminished over time. Differences in unadjusted death rates by race were relatively minor and have also decreased: the white and nonwhite rates were each 8.6 during the 1984-88 period, while the nonwhite rate exceeded the white rate (8.4 to 8.2) during the 1979-83 period. (2, 3) Nonwhites have a younger age structure than whites and this accounts for their similar unadjusted death rates.

These comparisons mask the exceedingly high overall mortality rate for nonwhite males. Adjusting the race-sex-specific rates for age using the 1940 U.S. population as the standard, the 1984-88 adjusted rate was lower than the unadjusted rate for each race-sex group except nonwhite males, who had a higher rate after adjustment. This finding implies that nonwhite males are dying at younger ages than any other race-sex group, a fact also revealed by the age-specific rates. With the exception of the 85+ age group (based on 1988 data), nonwhite males had the highest age-specific mortality rates of the four race-sex groups.

3-4

In each of the ten-year age groups between ages 25 and 54, the rates for nonwhite males were at least twice the rates for white males (the next highest group). However, after age 54, differences between white and nonwhite males are much smaller, and the rate for nonwhite males older than 84 is lower than that for white males.

In Sections IV through IX, important differences in risks of mortality by age, race, and sex groups will be described for each cause.

Underlying Causes of Death

A statistically complex study conducted by the CDC (4,5) shows that only 11 states ranked worse than North Carolina on a composite index based on 1986 age-adjusted mortality rates for nine causes* (i.e., stroke, coronary heart disease, cirrhosis, obstructive pulmonary disease, lung cancer, breast cancer, colorectal cancer, cervical cancer, and diabetes mellitus). These causes accounted for 52 percent of deaths nationally and in North Carolina during 1986.

Four major causes of mortality--heart disease, cerebrovascular disease, cancer, and cancer other than lung-- have exhibited interesting patterns of change in North Carolina over the past 38 years. The following figures depict cumulative percent changes in death rates for these causes as well as total mortality over seven successive time periods since 1950-59. Results are shown for four race-sex groups. The first figure represents decedents

_____

*Groupings of ICD codes for these diseases differ from the groupings used by CHES in this volume. These nine diseases were selected based on diversity in their mortality rates between 1979 and 1986.

45-64 years old at death. The cumulative percent increase in
lung cancer rates for each race-sex group is striking: it
exceeds 100 percent earliest (by the 1965-69 period) for nonwhite
men and white women and latest (by the 1975-79 period) for
nonwhite women. However, after the 1960-64 period, the rate of
increase for nonwhite women appears to accelerate.

CUMULATIVE PERCENT CHANGE IN DEATH RATES — SELECTED CAUSES OF DEATH
BY RACE AND SEX, AGE 45-64, SINCE TIME PERIOD 1950-1959

NORTH CAROLINA

TIME PERIODS

	Time Period 1: 1950-1959
Total Mortality	2: 1960-1964
Heart Disease	3: 1965-1969
Cerebrovascular Disease	4: 1970-1974
Cancer other than Lung	5: 1975-1979
Lung Cancer	6: 1980-1984
	7: 1985-1988
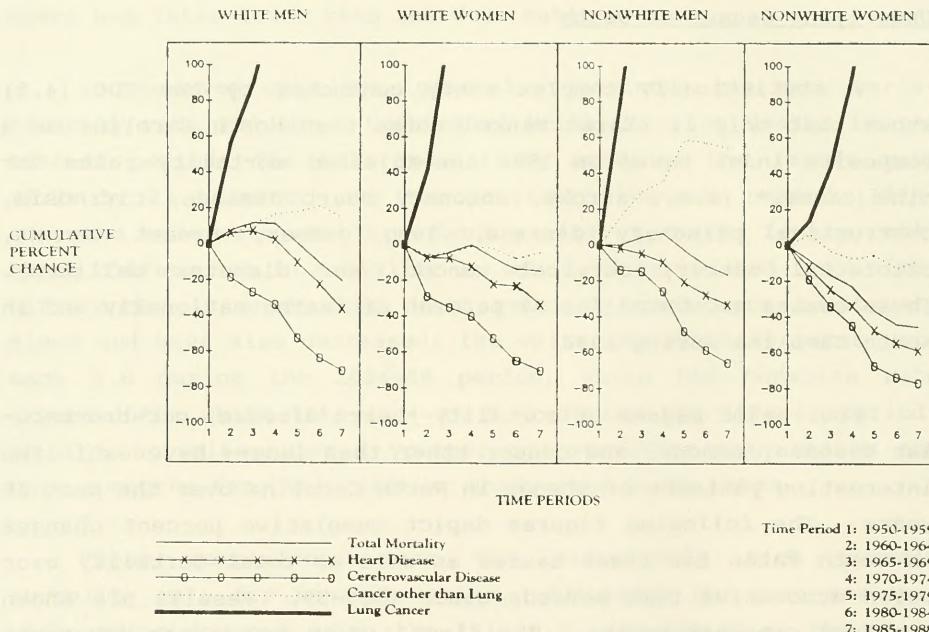
For nonwhite men, the cumulative percent change for cancer
other than lung increases sharply through the 1975-79 period,
after which a modest decline appears. The pattern for white men
is similar, but the cumulative percent increase is smaller and
the decline occurs later. Cumulative percent changes for white

3-6

women are relatively small with no clear trend, while the cumu-
lative changes for nonwhite women show a decreasing trend over
most of the time intervals.

The patterns and magnitudes of changes for total mortality,
heart disease, and cerebrovascular disease are essentially
similar among the race-sex groups: after the 1970-74 period, all
cumulative percent changes are negative, reflecting decreasing
mortality rates. Total mortality for white women declined the
least, while total mortality for nonwhite women showed the
greatest cumulative percent decrease. The cumulative percent
decrease for white men was greater than for nonwhite men.

The following figure presents the same information for
decedents in the 65-74 age group. While the lung cancer rate for
nonwhite women showed a slight decrease in the 1975-79 period,
the cumulative percent increase still exceeded 100 percent by the
1980-84 period. For the remaining causes, the pattern and
magnitude of changes in cumulative percentages are similar to the
preceding figure with one notable exception: for each race-sex
group except white women, the cumulative percent change for
cancer other than lung is clearly positive by the 1985-88 period.
Taken together, these figures show that the rates for total
mortality, heart disease, and cerebrovascular disease have
decreased for each race-sex group, while lung cancer rates have
increased. Cumulative percent changes for cancer other than lung
show clear increases for nonwhites and white males in the 65-74
age group, but only for nonwhite males in the 45-64 age group.
These trends are especially noteworthy because of the relatively
long time periods involved.

3-7

CUMULATIVE PERCENT CHANGE IN DEATH RATES — SELECTED CAUSES OF DEATH
BY RACE AND SEX, AGE 65-74, SINCE TIME PERIOD 1950-1959

NORTH CAROLINA

WHITE MEN   WHITE WOMEN   NONWHITE MEN   NONWHITE WOMEN

CUMULATIVE
PERCENT
CHANGE

TIME PERIODS

Total Mortality
×——×——×——×——× Heart Disease
o——o——o——o——o Cerebrovascular Disease
.... Cancer other than Lung
Lung Cancer

Time Period 1: 1950-1959
2: 1960-1964
3: 1965-1969
4: 1970-1974
5: 1975-1979
6: 1980-1984
7: 1985-1988
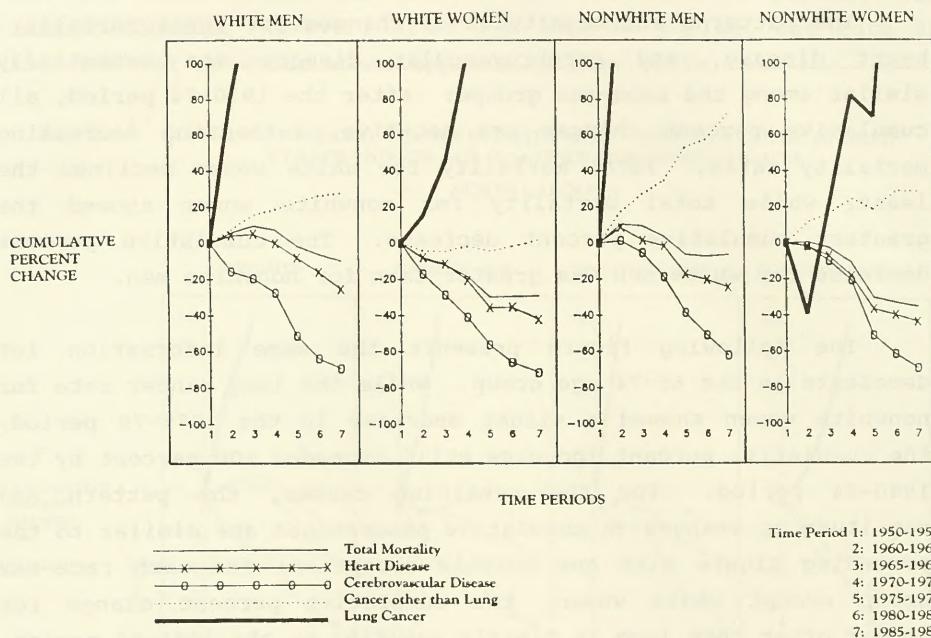
GEOGRAPHIC PATTERNS

The 1984-88 unadjusted total mortality rates for counties
(Figure 2.A) ranged from 4.3 in Onslow County to 12.9 in Swain
County, with a state rate of 8.9 per 1,000 population. Figure
2.A shows several scattered groups of high-rate counties, with
the northeast seemingly having the largest cluster. In some
cases, these high rates reflect unfavorable mortality conditions
other than age, race, and sex, since among the 33 counties in the
two highest rate levels (Figure 2.A), 16 were in the top three
levels after adjustment for age, race, and sex (Figure 2.B). In
addition, Figure 2.B shows a large band of contiguous, high-rate

3-8

counties extending from Virginia to South Carolina in the eastern third of North Carolina.

Based on procedures described in Section II of this volume, the clustering of 13 northeastern counties with high unadjusted death rates was found to be statistically significant (see map below). In fact, eight of the ten highest-rate counties are in the northeastern cluster. A smaller cluster of seven counties appears in the southwest. Together, these clusters include 20 of the 25 counties with the highest mortality rates in the 1984-88 period.

GENERAL MORTALITY

MORTALITY RATES PER 100,000 POPULATION

■ 11.13 to 12.87 (p<=.05)
■ 10.32 to 10.97 (p<=.05)
□ 4.30 to 10.32

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
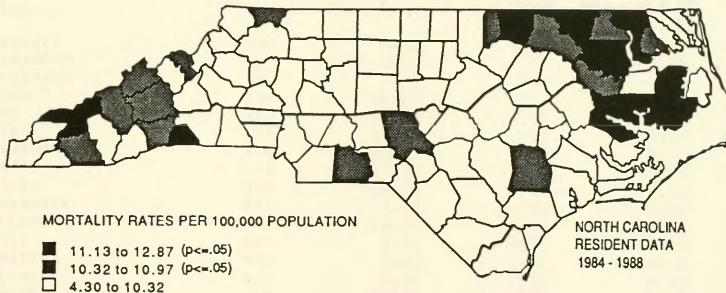
The cluster of high adjusted rates forming a north-south band of 19 eastern counties was also found to be statistically significant (see next map). Unlike the unadjusted rates, only a single two-county adjacency appears in the west. Thus, eastern North Carolina is experiencing high levels of mortality that cannot be explained on the basis of age, race, and sex factors. In this case, high mortality may be due to socioeconomic and health resource factors, or to some other set of local conditions that invite intervention. A similar north-south cluster appeared in the 1981 version of this volume (6); hence this grouping of counties with high rates of total mortality persists.

The cause-specific data in the sections to follow will aid counties in identifying their particular kinds of mortality proneness.

GENERAL MORTALITY

AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 POPULATION

- ■ 9.44 to 10.93 (p<=.05)
- ■ 9.35 to 9.42 (p<=.05)
- ▨ 9.28 to 9.35 (p<=.01)
- □ 7.07 to 9.20

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
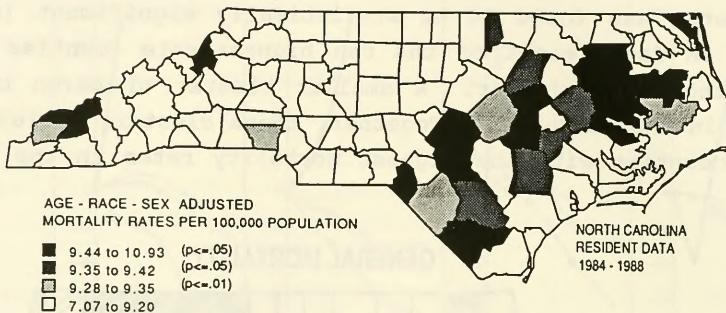
M O R T A L I T Y   S T A T I S T I C S   F O R   1 9 8 8

N O R T H   C A R O L I N A   R E S I D E N T S

T O T A L   D E A T H S (P E R   1 0 0 0   P O P U L A T I O N)

GEOGRAPHICAL AREA	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
NORTH CAROLINA	57630	8.88	271583	8.58	8.58
REGIONS					
DHR I WESTERN	20286	9.12	94940	8.76	8.41
DHR II N. CENTRAL	12431	9.11	59186	8.87	8.45
DHR III S. CENTRAL	12197	7.95	57264	7.71	8.71
DHR IV EASTERN	12716	9.29	60193	8.97	9.06
HSA I WESTERN	10693	9.75	50092	9.29	8.32
HSA II PIEDMONT	10746	8.94	51180	8.69	8.45
HSA III S. PIEDMONT	9593	8.50	44848	8.23	8.47
HSA IV CAPITAL	7532	7.76	35808	7.73	8.32
HSA V CARDINAL	8630	8.86	40202	8.41	9.13
HSA VI EASTERN	10436	9.31	49453	8.97	9.09
COUNTIES					
1 ALAMANCE	1057	9.98	4904	9.47	8.24
2 ALEXANDER	204	7.40	951	7.06	7.82
3 ALLEGHANY	97	9.87	515	10.56	8.12
4 ANSON	308	11.73	1362	10.38	8.58
5 ASHE	253	10.77	1163	9.96	8.81
6 AVERY	156	10.22	651	8.63	10.93
7 BEAUFORT	510	12.01	2356	11.13	9.78
8 BERTIE	249	11.83	1229	11.59	9.56
9 BLADEN	350	11.31	1523	9.88	9.39
10 BRUNSWICK	421	8.26	1964	8.27	8.19
11 BUNCOMBE	1846	10.65	8764	10.32	8.49
12 BURKE	689	8.91	3077	8.09	8.61
13 CABARRUS	902	9.40	4256	9.10	8.56
14 CALDWELL	621	8.69	2818	8.01	8.78
15 CAMDEN	62	10.23	289	9.78	8.90
16 CARTERET	484	9.48	2233	9.06	8.92
17 CASWELL	185	8.33	927	8.33	7.99
18 CATAWBA	953	8.12	4636	8.12	8.59
19 CHATHAM	361	9.82	1646	9.17	8.11
20 CHEROKEE	208	9.81	1006	9.79	7.31
21 CHOWAN	153	11.17	799	11.97	9.02
22 CLAY	71	9.76	368	10.29	7.61
23 CLEVELAND	844	9.68	3976	9.24	8.81
24 COLUMBUS	576	10.95	2644	10.10	9.54
25 CRAVEN	597	7.31	2733	6.84	8.61
26 CUMBERLAND	1562	6.13	7437	5.83	9.99
27 CURRITUCK	153	10.93	668	9.97	9.99
28 DARE	171	7.96	761	8.12	7.83
29 DAVIDSON	963	7.74	4868	8.02	8.44
30 DAVIE	250	8.97	1152	8.54	9.12
31 DUPLIN	466	11.18	2198	10.56	9.35
32 DURHAM	1480	8.63	7109	8.59	8.49
33 EDGECOMBE	630	10.51	2879	9.77	9.12
34 FORSYTH	2402	9.01	11376	8.71	8.38
35 FRANKLIN	351	9.90	1623	9.59	7.92
36 GASTON	1640	9.41	7677	8.93	9.33
37 GATES	118	12.05	544	11.41	8.87
38 GRAHAM	72	10.26	353	9.89	9.35
39 GRANVILLE	376	9.64	1849	9.85	8.77
40 GREENE	132	8.05	686	8.32	8.66
41 GUILFORD	2976	8.83	14214	8.60	8.41

* SEE SECTION II ; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

COUNTIES (CONT'D)	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
42 HALIFAX	635	11.17	3045	10.81	8.73
43 HARNETT	640	9.65	2909	9.07	9.75
44 HAYWOOD	534	11.06	2528	10.51	8.50
45 HENDERSON	840	12.12	3636	10.86	7.79
46 HERTFORD	257	10.85	1295	10.85	8.40
47 HOKE	172	7.17	750	6.48	7.98
48 HYDE	59	10.39	328	11.21	9.28
49 IREDELL	860	9.38	4018	9.05	8.46
50 JACKSON	218	8.05	1081	8.03	7.81
51 JOHNSTON	781	9.68	3656	9.37	9.30
52 JONES	97	9.85	478	9.69	8.26
53 LEE	360	8.58	1818	8.89	9.13
54 LENOIR	618	10.24	3037	10.05	9.41
55 LINCOLN	380	7.82	1817	7.82	8.51
56 MCDOWELL	398	10.95	1680	9.26	8.65
57 MACON	270	11.53	1257	10.87	8.82
58 MADISON	198	11.49	895	10.37	8.69
59 MARTIN	293	11.09	1410	10.63	9.44
60 MECKLENBURG	3564	7.48	16573	7.30	8.16
61 MITCHELL	164	11.15	794	10.92	7.11
62 MONTGOMERY	246	10.26	1137	9.49	8.47
63 MOORE	711	11.98	3093	10.96	8.58
64 NASH	684	9.40	3415	9.56	9.39
65 NEW HANOVER	1021	8.69	4938	8.65	9.07
66 NORTHAMPTON	273	12.34	1296	11.56	9.03
67 ONSLOW	530	4.22	2661	4.30	8.43
68 ORANGE	507	5.72	2462	5.82	7.54
69 PAMLICO	117	10.65	558	10.22	8.26
70 PASQUOTANK	321	10.46	1440	9.60	8.54
71 PENDER	262	9.67	1194	9.40	8.35
72 PERQUIMANS	147	13.32	569	10.83	7.80
73 PERSON	299	9.51	1398	9.11	8.20
74 PITT	812	7.95	3969	8.08	9.37
75 POLK	196	13.31	927	12.74	7.98
76 RANDOLPH	846	8.23	3813	7.68	8.32
77 RICHMOND	479	10.44	2310	10.11	9.18
78 ROBESON	1008	9.33	4768	8.94	9.31
79 ROCKINGHAM	848	9.80	4153	9.69	9.14
80 ROWAN	1099	10.31	5278	10.13	8.37
81 RUTHERFORD	594	10.27	2874	10.05	8.38
82 SAMPSON	549	10.78	2606	10.31	9.20
83 SCOTLAND	323	9.30	1567	9.21	10.30
84 STANLY	529	10.36	2392	9.50	8.55
85 STOKES	289	7.92	1399	7.82	8.52
86 SURRY	652	10.49	2975	9.70	8.65
87 SWAIN	158	15.02	685	12.87	10.03
88 TRANSYLVANIA	237	9.04	1103	8.59	7.66
89 TYRRELL	49	11.96	236	11.48	9.82
90 UNION	619	7.36	2837	7.08	8.33
91 VANCE	440	11.20	2082	10.76	9.42
92 WAKE	2358	6.06	11111	6.10	8.02
93 WARREN	219	13.17	1054	12.78	9.18
94 WASHINGTON	155	10.58	694	9.53	9.59
95 WATAUGA	242	6.97	1095	6.38	7.06
96 WAYNE	965	9.78	4437	9.03	9.92
97 WILKES	505	8.22	2570	8.43	8.67
98 WILSON	699	10.65	3210	9.89	9.86
99 YADKIN	278	9.16	1399	9.42	7.95
100 YANCEY	125	7.80	688	8.72	7.47

* SEE SECTION 11; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

GENERAL MORTALITY

MORTALITY RATES PER 100,000 POPULATION

- 12.75 to 12.87
- 10.05 to 11.97
- 8.55 to 9.97
- 7.69 to 8.44
- 5.82 to 7.30
- 4.30 to 4.30

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
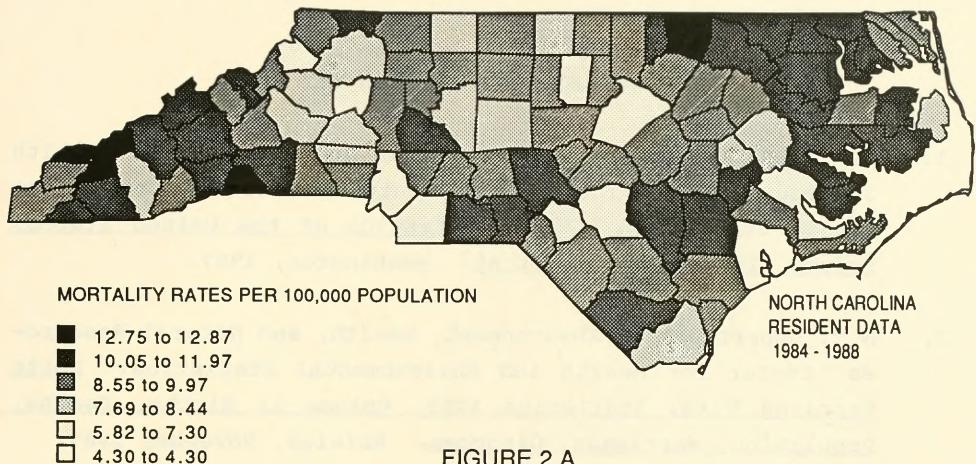
FIGURE 2.A

GENERAL MORTALITY

AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 POPULATION

- 10.93 to 10.93
- 9.75 to 10.30
- 9.02 to 9.59
- 8.33 to 8.92
- 7.80 to 8.26
- 7.07 to 7.67

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
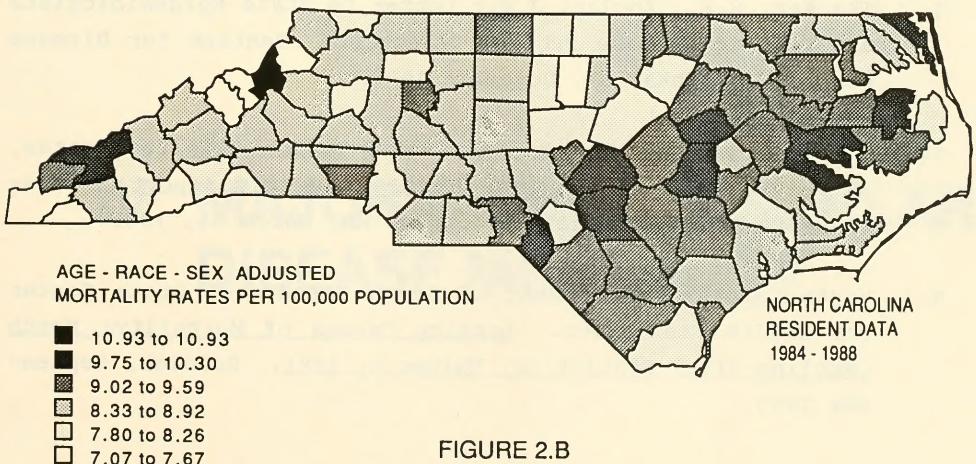
FIGURE 2.B

REFERENCES FOR SECTION III

1. U.S. Department of Health and Human Services. Public Health Service, Centers for Disease Control, National Center for Health Statistics. <u>Vital Statistics of the United States, Volume II-Mortality (Part A)</u>. Washington, 1987.

2. N.C. Department of Environment, Health, and Natural Resources, Center for Health and Environmental Statistics. <u>North Carolina Vital Statistics 1988, Volume 1: Births, Deaths, Population, Marriages, Divorces</u>. Raleigh, November 1989.

3. North Carolina Department of Human Resources, State Center for Health Statistics. <u>North Carolina Vital Statistics 1983, Volume 1: Births, Deaths, Population, Marriages, Divorces</u>. Raleigh, March 1983.

4. Thacker. S.B.; Koplan, J.P.; Letter to State Epidemiologists and Chronic Disease Program Directors. Centers for Disease Control, Atlanta, GA, November 1989.

5. "Chronic Disease Reports: Mortality Trends - United States, 1979-1986." <u>Morbidity and Mortality Weekly Report</u>, Massachusetts Medical Society, Waltham, MA, March 31, 1989.

6. North Carolina Department of Human Resources, State Center for Health Statistics. <u>Leading Causes of Mortality: North Carolina Vital Statistics, Volume 2, 1981</u>. Raleigh, September 1983.

IV. MAJOR CARDIOVASCULAR DISEASE MORTALITY

HEART DISEASE

Nearly 34 percent of deaths among North Carolina residents in 1988 resulted from heart disease, which has been the leading cause of death for the state and the nation for more than 50 years (1). Heart disease ranks second behind cancer in potential years of life lost by all North Carolinians. It ranks first among nonwhite females.

Diseases of the heart accounted for 19,421 North Carolina deaths in 1988, a rate of 299.4 per 100,000 population. While the 1987 rate for the United States was higher at 312.4, North Carolina's 1987 age-adjusted rate was 6.2 percent higher than the nation's (2). In 1986, N.C.'s age-adjusted coronary heart disease death rate was the tenth highest among the 50 states (3).

The risk of death from heart disease has declined in North Carolina, with the 1984-88 age-adjusted rate representing an 11 percent decrease since 1979-83. The largest decrease was among white males for whom the 1984-88 age-adjusted rate was down about 15 percent. Age-adjusted rates for the other race-sex groups also declined, for white females by 9 percent and for each of nonwhite males and females by 4 percent.

RISK FACTORS

A number of alterable risk factors for heart disease exist. Among these are smoking, hypertension, elevated cholesterol,

obesity, and sedentary lifestyle (3). Cigarette smoking is the single factor responsible for the most preventable deaths in our society, the largest numbers of those excess deaths being due to coronary heart disease, lung cancer, and chronic obstructive lung disease (4).

The smoking behavior of the U.S. population has changed dramatically, from 52 percent of men and 34 percent of women in 1965 to 33 percent of men and 28 percent of women in 1985. In 1985, however, the North Carolina age-adjusted percentage of current smokers among men ranked in the top quartile among the 50 states. North Carolina women did better, ranking in the second lowest quartile. (4)

North Carolina's decrease in heart disease death rates is consistent with a decline nationwide. Possible reasons for the decline include smoking cessation, increased control of hypertension, dietary changes, reduced serum cholesterol levels, and improvements in medical care (4). In recent years, the ability of aspirin to prevent the occurrence or recurrence of vaso-occlusion has been studied extensively. Taken together, the results of these studies are highly suggestive of a beneficial effect of aspirin. (5)

GEOGRAPHIC PATTERNS

Unadjusted and age-race-sex-adjusted heart disease death rates for 1984-88 are depicted in Figures 3.A and 3.B respectively. After adjustment, a number of contiguous high-rate counties are found to exist, almost exclusively in the east.

Based on the procedures described in Section II of this report, the following map reveals that, of the 25 counties with the highest unadjusted death rates, statistically significant

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geographic clusters exist in the east-northeast and in the west-southwest.

DISEASES OF THE HEART

MORTALITY RATES PER 100,000 POPULATION

- ■ 391.55 to 533.67 (p<=.01)
- ■ 385.69 to 390.73 (p<=.01)
- ▨ 381.00 to 383.02 (p<=.01)
- □ 116.71 to 380.37

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
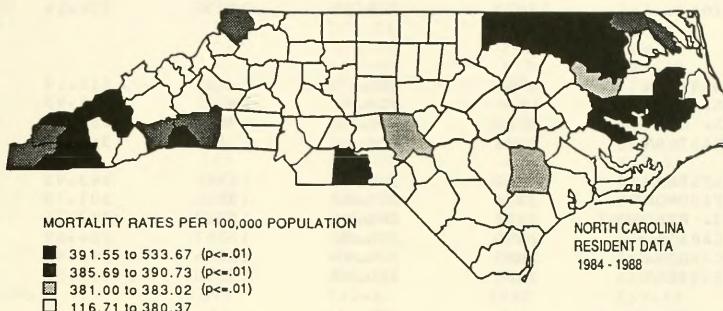
After adjustment for age, race, and sex, clusters of high-rate counties are no longer statistically significant. The interpretation here is that no significant clusters of counties are experiencing higher levels of heart disease mortality than can be explained on the basis of age, race, and sex. This is in sharp contrast to a significant spatial grouping of 15 counties observed in 1979-81 (6).

M O R T A L I T Y   S T A T I S T I C S   F O R   1 9 8 8

N O R T H   C A R O L I N A   R E S I D E N T S

D I S E A S E S   O F   T H E   H E A R T

GEOGRAPHICAL AREA	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
NORTH CAROLINA	19421	299.36	96235	304.14	304.14
REGIONS					
OHR I WESTERN	6984	314.09	34481	318.19	298.08
OHR II N. CENTRAL	4206	308.51	21075	315.95	297.75
OHR III S. CENTRAL	4010	261.61	19573	263.57	307.39
OHR IV EASTERN	4221	308.60	21106	314.62	324.75
HSA I WESTERN	3732	340.62	18544	343.93	293.51
HSA II PIEDMONT	3581	298.02	18111	307.78	295.51
HSA III S. PIEDMONT	3252	288.31	15937	292.71	300.20
HSA IV CAPITAL	2490	256.82	12257	264.69	291.08
HSA V CAROINAL	2885	296.49	13996	292.91	327.36
HSA VI EASTERN	3481	310.87	17390	315.51	328.25
COUNTIES					
1 ALAMANCE	359	338.98	1751	338.32	286.83
2 ALEXANDER	86	312.01	378	280.87	304.87
3 ALLEGHANY	26	264.79	167	341.82	256.12
4 ANSON	113	430.65	540	411.76	327.24
5 ASHE	93	395.94	456	390.69	259.93
6 AVERY	60	393.33	262	347.57	446.96
7 BEAUFORT	165	388.85	869	410.65	361.73
8 BERTIE	88	418.29	440	415.08	357.72
9 BLADEN	115	371.78	550	356.89	353.03
10 BRUNSWICK	151	296.33	698	293.92	293.84
11 BUNCOMBE	562	324.48	2967	349.42	274.73
12 BURKE	228	294.91	1209	317.99	336.50
13 CABARRUS	323	336.66	1502	321.36	293.72
14 CALDWELL	206	288.31	1030	292.99	316.04
15 CAMDEN	19	313.68	94	318.24	279.43
16 CARTERET	159	311.53	837	339.78	326.93
17 CASWELL	65	292.88	324	291.32	288.06
18 CATAWBA	331	282.06	1753	307.22	318.05
19 CHATHAM	127	345.70	598	333.27	291.70
20 CHEROKEE	78	368.16	400	389.64	249.71
21 CHOWAN	45	328.58	253	379.14	282.37
22 CLAY	27	371.18	140	391.55	291.26
23 CLEVELAND	316	362.73	1559	362.34	339.09
24 COLUMBUS	189	359.57	995	380.37	358.36
25 CRAVEN	206	252.48	915	229.11	304.08
26 CUMBERLAND	521	204.62	2446	191.94	376.47
27 CURRITUCK	45	321.72	237	353.88	357.72
28 DARE	49	228.33	245	261.60	250.92
29 DAVIDSON	340	273.54	1799	296.60	307.52
30 DAVIE	80	287.29	417	309.41	323.72
31 DUPLIN	164	393.72	795	382.11	340.67
32 DURHAM	447	260.66	2287	276.49	279.07
33 EDGECOMBE	188	313.92	955	324.17	319.13
34 FORSYTH	778	292.09	3941	302.08	288.40
35 FRANKLIN	121	341.37	627	370.73	303.74
36 GASTON	606	347.88	3031	352.68	367.63
37 GATES	44	449.43	184	386.19	289.41
38 GRAHAM	28	399.03	138	386.93	396.55
39 GRANVILLE	141	361.77	674	359.11	327.19
40 GREENE	44	268.52	256	310.57	350.67
41 GUILFORD	915	271.64	4791	290.11	282.42

* SEE SECTION II; RATES BASED ON SMALL NUMBERES MAY BE UNRELIABLE.

COUNTIES (CONT'D)	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
42 HALIFAX	217	381.77	1137	403.98	335.80
43 HARNETT	201	303.23	1030	321.41	350.06
44 HAYWOOD	185	383.26	988	411.05	325.72
45 HENDERSON	298	430.27	1296	387.19	252.85
46 HERTFORD	89	376.01	468	392.44	307.12
47 HOKE	54	225.25	260	224.82	294.19
48 HYDE	19	334.68	115	393.22	320.90
49 IREDELL	311	339.54	1457	328.28	301.47
50 JACKSON	69	255.08	406	301.93	284.54
51 JOHNSTON	283	350.83	1440	369.11	365.99
52 JONES	32	324.97	153	310.31	269.50
53 LEE	125	298.05	679	332.31	342.48
54 LENOIR	240	398.05	1145	378.99	360.00
55 LINCOLN	150	308.71	670	288.69	310.76
56 MCDOWELL	137	376.97	638	351.70	306.76
57 MACON	87	371.73	457	395.53	279.53
58 MADISON	70	406.22	312	361.81	251.25
59 MARTIN	96	363.40	505	380.99	356.36
60 MECKLENBURG	1099	230.86	5440	239.73	274.74
61 MITCHELL	61	414.99	266	365.90	210.17
62 MONTGOMERY	84	347.52	401	334.88	293.15
63 MOORE	244	411.34	1080	383.01	286.01
64 NASH	240	329.94	1237	346.30	343.90
65 NEW HANOVER	326	277.64	1638	286.96	302.66
66 NORTHAMPTON	86	388.99	447	398.95	324.76
67 ONSLOW	131	104.37	722	116.71	264.49
68 ORANGE	157	177.43	740	175.10	232.96
69 PAMLICO	40	364.29	189	346.24	269.09
70 PASQUOTANK	124	404.23	586	390.73	344.64
71 PENDER	74	273.24	385	303.37	267.52
72 PERQUIMANS	39	353.48	187	356.13	247.96
73 PERSON	116	369.16	531	346.26	307.63
74 PITT	236	231.35	1351	275.18	336.18
75 POLK	77	523.02	327	449.71	262.35
76 RANDOLPH	292	284.17	1388	279.80	292.73
77 RICHMOND	173	377.23	799	349.87	315.37
78 ROBESON	333	308.28	1656	310.69	334.02
79 ROCKINGHAM	310	358.45	1538	359.14	335.01
80 ROWAN	369	346.42	1865	358.19	287.02
81 RUTHERFORD	236	408.23	1102	385.68	305.91
82 SAMPSON	198	389.05	954	377.69	337.25
83 SCOTLAND	109	314.10	564	331.68	386.06
84 STANLY,	176	344.79	894	355.12	305.01
85 STOKES	119	326.14	541	302.73	339.33
86 SURRY	226	363.87	1107	360.99	300.22
87 SWAIN	65	617.98	284	533.67	377.41
88 TRANSYLVANIA	78	297.84	372	289.90	244.83
89 TYRRELL	17	415.14	97	471.85	385.41
90 UNION	218	259.50	1078	269.28	320.34
91 VANCE	175	445.61	774	400.17	353.16
92 WAKE	726	186.87	3549	194.88	266.92
93 WARREN	72	433.08	358	434.26	321.71
94 WASHINGTON	60	409.86	239	328.46	335.86
95 WATAUGA	90	259.57	422	245.88	278.12
96 WAYNE	367	372.11	1655	336.91	385.41
97 WILKES	195	317.45	985	323.38	325.08
98 WILSON	232	353.75	1077	332.03	337.32
99 YADKIN	97	319.89	514	346.09	284.15
100 YANCEY	43	268.56	230	291.62	229.91

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

DISEASES OF THE HEART

MORTALITY RATES PER 100,000 POPULATION

- 533.67 to 533.67
- 434.26 to 471.86
- 317.99 to 415.08
- 261.60 to 310.69
- 175.11 to 245.89
- 116.71 to 116.71

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
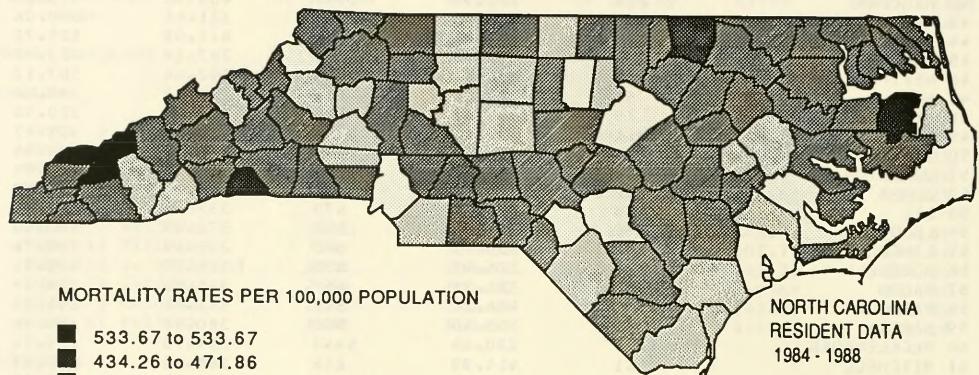
FIGURE 3.A

DISEASES OF THE HEART

AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 POPULATION

- 446.96 to 446.96
- 350.06 to 396.55
- 315.38 to 344.64
- 274.73 to 310.77
- 244.84 to 269.50
- 210.17 to 232.97

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
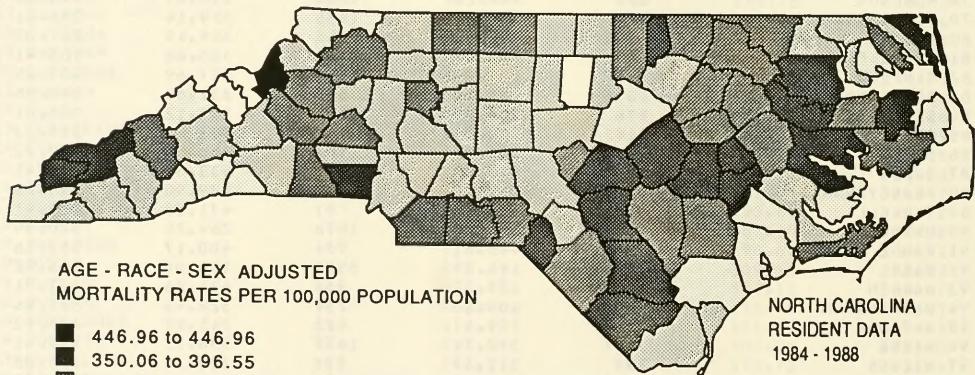
FIGURE 3.B

CEREBROVASCULAR DISEASE

Cerebrovascular disease, or stroke, claimed the lives of 4,780 North Carolinians during 1988. It was the third leading cause of death in North Carolina with an overall rate of 73.7 deaths per 100,000 population. The North Carolina unadjusted rate was 15 percent higher than the 1987 U.S. rate, and the state's 1987 age-adjusted rate was 24 percent higher than the nation's (2). In 1986, North Carolina's age-adjusted stroke death rate was the third highest in the nation, exceeded only by rates for South Carolina and Georgia (7).

The state's age-adjusted cerebrovascular mortality rate dropped a dramatic 19 percent between 1979-83 and 1984-88. By race and sex, the reductions ranged from 14 percent for nonwhite females to 21 percent for white males. The age-adjusted rates for nonwhite males and females remain considerably higher than those for whites.

RISK FACTORS

The risk factors associated with cerebrovascular disease are essentially the same as those for heart disease: hypertension, diabetes, cardiac impairment, elevated blood lipids, obesity, and cigarette smoking. The large racial differential is at least partially explained by the higher prevalence of hypertension and diabetes among the black population. (4)

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In addition to lifestyle changes, other factors possibly associated with reduced cerebrovascular and other cardiovascular mortality are improved patient and physician education and increased availability of medical services including rescue squads, coronary care units, and physician supply (8). Improvements in hypertension detection and control have probably contributed to the observed declines (4). There is convincing evidence from several studies for the efficacy of aspirin in the prevention of stroke (5).

GEOGRAPHIC PATTERNS

Figure 4.A shows a scattering of counties with relatively high unadjusted rates and several pockets of high-rate counties, primarily in the east. After adjusting for age, race, and sex (Figure 4.B), even more counties appear in the high-rate groups, and nearly all are contiguous to other high-rate counties.

Based on procedures described in Section II, the eastern pockets of high unadjusted county rates were found to cluster significantly (see first map on next page). Spatial clustering continues to prevail in the east after adjusting for age, race, and sex (see second map on next page). Thus, it is clear that some eastern North Carolina counties are experiencing inordinately high cerebrovascular mortality that cannot be explained by age, race, and sex factors. Both the unadjusted and adjusted cerebrovascular death rates of 1979-81 exhibited similar clustering properties (6).

CEREBROVASCULAR DISEASE
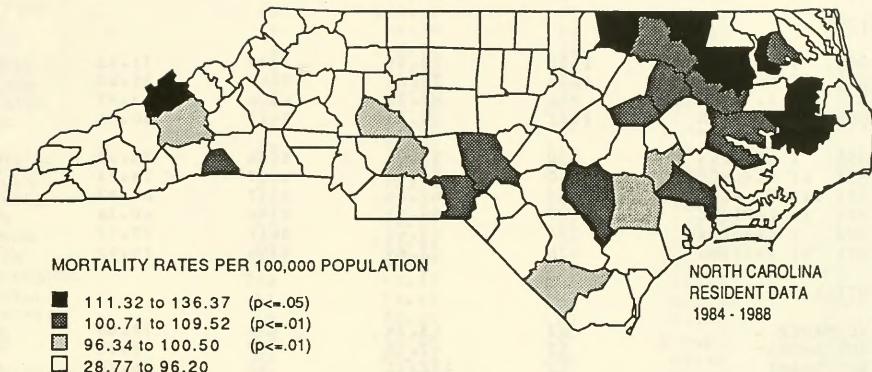
MORTALITY RATES PER 100,000 POPULATION

- ■ 111.32 to 136.37 (p<=.05)
- ▨ 100.71 to 109.52 (p<=.01)
- ▦ 96.34 to 100.50 (p<=.01)
- □ 28.77 to 96.20

NORTH CAROLINA
RESIDENT DATA
1984 - 1988

CEREBROVASCULAR DISEASE

AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 POPULATION

- ■ 84.57 to 105.88 (p<=.05)
- □ 33.47 to 84.37

NORTH CAROLINA
RESIDENT DATA
1984 - 1988

4-11
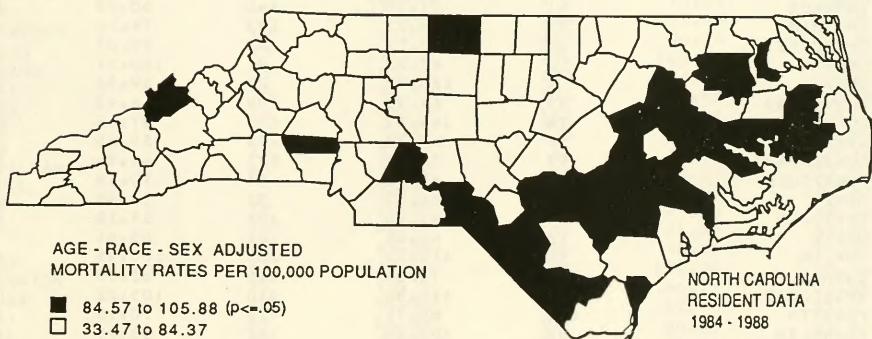
M O R T A L I T Y   S T A T I S T I C S   F O R   1 9 8 8

N O R T H   C A R O L I N A   R E S I D E N T S

C E R E B R O V A S C U L A R

GEOGRAPHICAL AREA	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
NORTH CAROLINA	4780	73.68	22931	72.47	72.47
REGIONS					
DHR I WESTERN	1623	72.99	7763	71.63	68.97
DHR II N. CENTRAL	1034	75.84	5045	75.63	71.13
DHR III S. CENTRAL	962	62.76	4706	63.37	73.34
DHR IV EASTERN	1161	84.88	5417	80.74	80.94
HSA I WESTERN	860	78.49	3986	73.92	65.92
HSA II PIEDMONT	900	74.90	4367	74.21	71.34
HSA III S. PIEDMONT	763	67.64	3777	69.37	72.33
HSA IV CAPITAL	577	59.51	2796	60.38	65.13
HSA V CARDINAL	754	77.49	3611	75.57	84.06
HSA VI EASTERN	926	82.69	4394	79.72	79.47
COUNTIES					
1 ALAMANCE	67	63.26	376	72.65	62.48
2 ALEXANDER	13	47.16	57	42.35	42.51
3 ALLEGHANY	12	122.21	47	96.20	69.52
4 ANSON	30	114.33	110	83.87	65.60
5 ASHE	22	93.66	82	70.25	58.94
6 AVERY	10	65.55	35	46.43	36.97
7 BEAUFORT	40	94.26	218	103.01	89.04
8 BERTIE	25	118.83	118	111.31	89.31
9 BLADEN	26	84.05	130	84.35	77.23
10 BRUNSWICK	29	56.91	132	55.58	57.81
11 BUNCOMBE	170	98.15	818	96.33	76.44
12 BURKE	49	63.38	203	53.39	56.38
13 CABARRUS	72	75.04	360	77.02	74.10
14 CALDWELL	49	68.57	195	55.47	59.82
15 CAMDEN	5	82.54	21	71.09	64.11
16 CARTERET	37	72.49	151	61.30	68.40
17 CASWELL	15	67.58	83	74.63	71.28
18 CATAWBA	61	51.98	346	60.63	68.26
19 CHATHAM	35	95.27	133	74.12	62.74
20 CHEROKEE	16	75.52	82	79.87	57.99
21 CHOWAN	12	87.62	91	136.37	92.42
22 CLAY	9	123.72	25	69.92	43.59
23 CLEVELAND	59	67.72	288	66.93	64.71
24 COLUMBUS	76	144.59	255	97.48	94.57
25 CRAVEN	52	63.73	223	55.83	74.58
26 CUMBERLAND	97	38.09	573	44.96	92.94
27 CURRITUCK	12	85.79	47	70.18	71.45
28 DARE	19	88.53	53	56.59	55.56
29 DAVIDSON	64	51.48	359	59.18	65.60
30 DAVIE	18	64.64	86	63.81	73.61
31 DUPLIN	48	115.23	209	100.45	84.57
32 DURHAM	124	72.31	516	62.38	58.91
33 EDGECOMBE	70	116.88	310	105.22	95.75
34 FORSYTH	215	80.71	915	70.13	65.64
35 FRANKLIN	38	107.20	142	83.96	66.72
36 GASTON	136	78.07	659	76.68	80.18
37 GATES	9	91.93	29	60.86	45.53
38 GRAHAM	5	71.25	18	50.46	33.47
39 GRANVILLE	33	84.66	164	87.38	72.71
40 GREENE	7	42.71	58	70.36	68.96
41 GUILFORD	272	80.75	1313	79.50	75.56

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

COUNTIES (CONT'D)	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
42 HALIFAX	65	114.35	288	102.32	77.45
43 HARNETT	47	70.90	217	67.71	74.22
44 HAYWOOD	41	84.94	188	78.21	66.71
45 HENDERSON	80	115.51	319	95.30	59.08
46 HERTFORD	25	105.62	96	80.50	58.20
47 HOKE	14	58.39	53	45.83	52.30
48 HYDE	8	140.91	39	133.35	97.73
49 IREDELL	78	85.16	364	82.01	75.81
50 JACKSON	15	55.45	70	52.05	45.34
51 JOHNSTON	55	68.18	276	70.74	71.25
52 JONES	8	81.24	54	109.52	86.99
53 LEE	24	57.22	116	56.77	58.44
54 LENOIR	57	94.53	292	96.65	88.09
55 LINCOLN	37	76.14	179	77.12	84.97
56 MCDOWELL	37	101.81	150	82.68	84.36
57 MACON	13	55.54	84	72.70	52.73
58 MADISON	23	133.47	99	114.80	101.34
59 MARTIN	22	83.27	141	106.37	82.95
60 MECKLENBURG	238	49.99	1252	55.17	63.24
61 MITCHELL	11	74.83	60	82.53	46.34
62 MONTGOMERY	19	78.60	100	83.51	71.46
63 MOORE	66	111.26	295	104.62	79.92
64 NASH	62	85.23	298	83.42	81.36
65 NEW HANOVER	108	91.97	523	91.62	96.82
66 NORTHAMPTON	28	126.65	128	114.24	75.51
67 ONSLOW	36	28.68	178	28.77	69.68
68 ORANGE	30	33.90	192	45.43	59.90
69 PAMLICO	9	81.96	42	76.94	61.00
70 PASQUOTANK	21	68.45	91	60.67	52.71
71 PENDER	22	81.23	113	89.04	80.38
72 PERQUIMANS	18	163.14	54	102.84	67.51
73 PERSON	15	47.73	130	84.77	75.94
74 PITT	81	79.40	366	74.54	84.87
75 POLK	6	40.75	79	108.64	60.00
76 RANDOLPH	69	67.15	377	75.99	83.32
77 RICHMOND	38	82.86	230	100.71	88.92
78 ROBESON	90	83.32	447	83.86	87.50
79 ROCKINGHAM	87	100.59	401	93.63	88.17
80 ROWAN	117	109.84	518	99.48	79.31
81 RUTHERFORD	47	81.30	269	94.14	76.27
82 SAMPSON	57	112.00	276	109.26	94.40
83 SCOTLAND	35	100.85	157	92.32	105.87
84 STANLY	49	95.99	253	100.50	93.79
85 STOKES	24	65.77	111	62.11	69.23
86 SURRY	45	72.45	230	75.00	69.25
87 SWAIN	10	95.07	42	78.92	60.19
88 TRANSYLVANIA	21	80.18	82	63.90	46.67
89 TYRRELL	5	122.10	23	111.88	100.86
90 UNION	36	42.85	192	47.96	59.02
91 VANCE	26	66.20	139	71.86	52.96
92 WAKE	175	45.04	885	48.59	67.99
93 WARREN	22	132.33	103	124.94	63.36
94 WASHINGTON	11	75.14	44	60.47	71.55
95 WATAUGA	20	57.68	82	47.77	51.21
96 WAYNE	64	64.89	397	80.81	86.93
97 WILKES	49	79.77	216	70.91	79.73
98 WILSON	70	106.73	335	103.28	102.43
99 YADKIN	24	79.15	116	78.10	65.96
100 YANCEY	12	74.94	50	63.39	64.34 *

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

CEREBROVASCULAR DISEASE

MORTALITY RATES PER 100,000 POPULATION

- ■ 124.94 to 136.37
- ■ 99.49 to 114.81
- ▨ 87.38 to 97.48
- ▨ 66.94 to 84.77
- ☐ 42.35 to 63.90
- ☐ 28.77 to 28.77

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
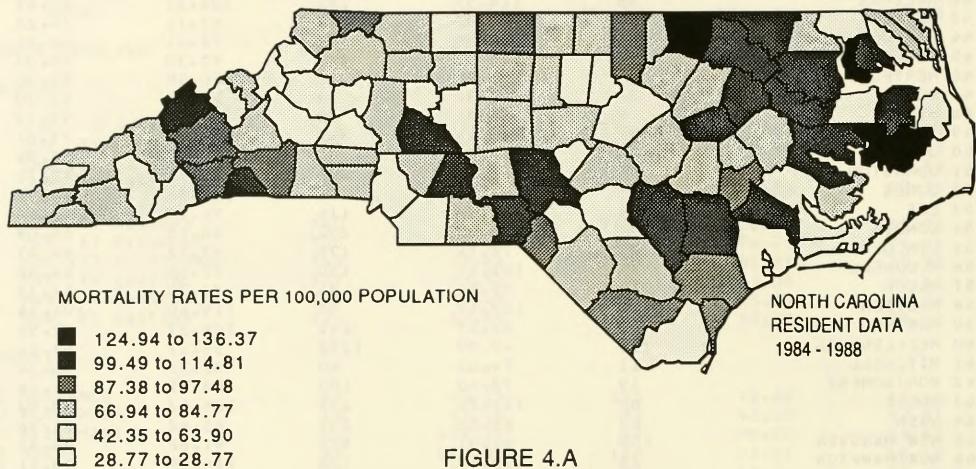
FIGURE 4.A

CEREBROVASCULAR DISEASE

AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 POPULATION

- ■ 92.42 to 105.88
- ■ 73.61 to 89.32
- ▨ 62.48 to 72.72
- ▨ 51.21 to 61.01
- ☐ 42.51 to 46.67
- ☐ 33.47 to 36.98

NORTH CAROLINA
RESIDENT DATA
1984 - 1988

FIGURE 4.B

4-14
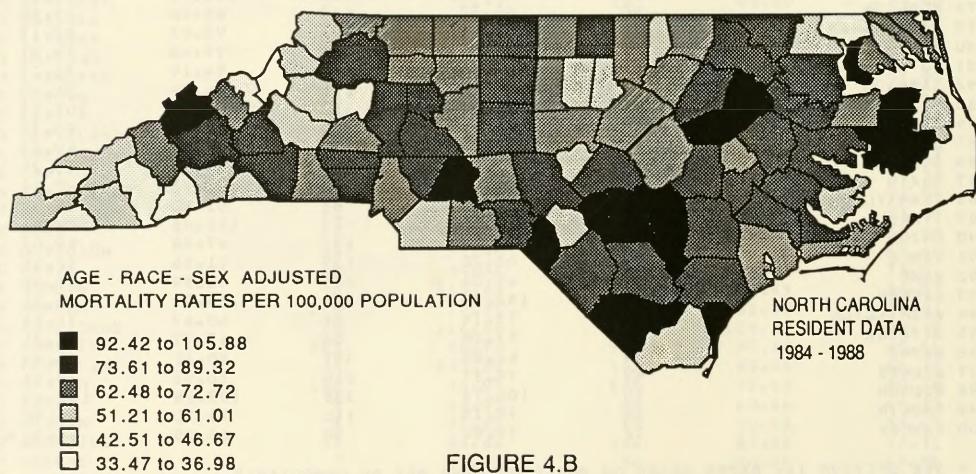
ATHEROSCLEROSIS

Atherosclerosis is a general term covering a number of diseases of the blood vessels and is often called "hardening of the arteries." Like hypertension, atherosclerosis is listed as a contributing cause on the death certificate far more often than it is considered the underlying cause of death. In particular, atherosclerosis contributes to deaths from heart disease, stroke, and diabetes. It was estimated that in 1970, 87 percent of the more than 1 million deaths in the United States due to heart and blood vessel diseases were attributable to atherosclerosis and its sequelae (1).

As the underlying cause of death, atherosclerosis accounted for 414 North Carolina deaths in 1988, a rate of 6.4 deaths per 100,000 population. The 1987 U.S. rate was considerably higher at 9.2. However, after adjustment for age, the 1987 N.C. and U.S. rates were virtually the same at 3.4 and 3.6 respectively. (2)

The recent decline in North Carolina's age-adjusted atherosclerosis mortality far exceeded the declines observed for heart disease and stroke, and the decline was virtually the same for all race-sex groups at an average 28 percent between 1979-83 and 1984-88.

Noteworthy are the race and sex differentials. The 1984-88 white male rate was about a third higher than that for white females, and the nonwhite male rate exceeded that for nonwhite females by 58 percent. Nonwhite rates were considerably higher

than the white rates, 54 percent higher for males and 31 percent higher for females.

Compared to 414 deaths with atherosclerosis as the underlying cause, a total of 12,329 death certificates had a mention of atherosclerosis. This suggests that 21 percent of all North Carolina deaths in 1988 involved atherosclerosis, though it is not known just how completely this condition is recorded on the death certificate. Of these 12,329 deaths with mention of atherosclerosis, 66 percent had heart disease as the underlying cause of death and 12 percent had cerebrovascular disease as the underlying cause. Around 40 percent of the deaths with heart disease and 30 percent of those with cerebrovascular disease as the underlying cause had a mention of atherosclerosis, and about 35 percent of the deaths with a mention of heart or cerebrovascular disease had a mention of atherosclerosis. These data are from Tables 23 and 24 of this report.

RISK FACTORS

Three major treatable risk factors contributing to atherosclerosis have been identified: elevated blood cholesterol levels, high blood pressure, and cigarette smoking. A number of additional factors are also recognized: diabetes, physical inactivity, obesity, age, male sex, and certain personality types, that is, "type A" or coronary-prone behavior. (1)

Increasing epidemiological evidence supports the hypothesis that higher concentrations of high-density lipoproteins (HDLs) may be a protective factor in the development of atherosclerosis. "Levels of HDL have been correlated positively with exercise and moderate ingestion of alcohol and inversely related to obesity, smoking, poor control of diabetes, and the use of progestin-containing contraceptives" (1). However, the cause and effect of the inverse relationship between HDL and atherosclerosis remain unclear.

GEOGRAPHIC PATTERNS

The clustering procedures described in Section II of this report revealed no statistically significant clusters of counties with high unadjusted or adjusted atherosclerosis death rates. Although a cluster of six southcentral counties was identified by the adjusted rates of 1979-81, it was noted that the pattern should be considered cautiously due to very small numerators in the six counties' rates (6). Due to this problem in most counties of the state, the two maps on atherosclerosis use mentioned conditions rather than underlying cause data. These maps, along with an associated analysis, are presented in the Multiple Conditions Section (Section IX) and show 1988 atherosclerosis mentions per 100,000 population.

M O R T A L I T Y   S T A T I S T I C S   F O R   1 9 8 8

N O R T H   C A R O L I N A   R E S I D E N T S

A T H E R O S C L E R O S I S

GEOGRAPHICAL AREA	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
NORTH CAROLINA	414	6.38	2548	8.05	8.05
REGIONS					
DHR I WESTERN	144	6.47	864	7.97	7.28
DHR II N. CENTRAL	68	4.98	523	7.84	7.27
DHR III S. CENTRAL	95	6.19	597	8.03	9.31
DHR IV EASTERN	107	7.82	564	8.40	8.97
HSA I WESTERN	78	7.11	471	8.73	7.31
HSA II PIEDMONT	60	4.99	480	8.15	7.66
HSA III S. PIEDMONT	66	5.85	393	7.21	7.41
HSA IV CAPITAL	63	6.49	378	8.16	8.79
HSA V CARDINAL	61	6.26	354	7.40	8.41
HSA VI EASTERN	86	7.68	472	8.56	9.17
COUNTIES					
1 ALAMANCE	5	4.72	71	13.71	11.83
2 ALEXANDER	0	0.00	7	5.20	5.17
3 ALLEGHANY	2	20.36	5	10.23	5.86
4 ANSON	0	0.00	5	3.81	2.40
5 ASHE	4	17.02	12	10.28	5.62
6 AVERY	0	0.00	3	3.97	3.53
7 BEAUFORT	2	4.71	11	5.19	4.76
8 BERTIE	0	0.00	8	7.54	7.08
9 BLADEN	4	12.93	18	11.68	10.98
10 BRUNSWICK	5	9.81	13	5.47	6.15
11 BUNCOMBE	24	13.85	118	13.89	10.86
12 BURKE	1	1.29	14	3.68	3.75
13 CABARRUS	3	3.12	17	3.63	3.45
14 CALDWELL	1	1.39	16	4.55	4.28
15 CAMDEN	0	0.00	5	16.92	14.23
16 CARTERET	1	1.95	6	2.43	1.80
17 CASWELL	2	9.01	7	6.29	5.73
18 CATAWBA	3	2.55	24	4.20	4.36
19 CHATHAM	4	10.88	17	9.47	7.71
20 CHEROKEE	0	0.00	1	0.97	0.57
21 CHOWAN	5	36.50	14	20.98	15.49
22 CLAY	0	0.00	3	8.39	3.49
23 CLEVELAND	5	5.73	32	7.43	6.86
24 COLUMBUS	2	3.80	15	5.73	5.24
25 CRAVEN	7	8.57	30	7.51	9.85
26 CUMBERLAND	4	1.57	47	3.68	8.06
27 CURRITUCK	0	0.00	6	8.95	9.71
28 DARE	1	4.65	20	21.35	20.31
29 DAVIDSON	4	3.21	56	9.23	9.81
30 DAVIE	0	0.00	7	5.19	6.44
31 DUPLIN	5	12.00	29	13.93	12.40
32 DURHAM	31	18.07	156	18.86	17.68
33 EDGECOMBE	6	10.01	26	8.82	8.88
34 FORSYTH	12	4.50	66	5.05	4.78
35 FRANKLIN	1	2.82	6	3.54	2.64
36 GASTON	12	6.88	53	6.16	6.57
37 GATES	1	10.21	5	10.49	6.26
38 GRAHAM	2	28.50	4	11.21	8.04
39 GRANVILLE	2	5.13	13	6.92	5.79
40 GREENE	2	12.20	3	3.63	4.59
41 GUILFORD	30	8.90	171	10.35	9.59

* SEE SECTION 11; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

COUNTIES (CONT'D)	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
42 HALIFAX	6	10.55	37	13.14	9.15
43 HARNETT	3	4.52	15	4.68	5.27
44 HAYWOOD	2	4.14	17	7.07	7.68
45 HENDERSON	6	8.66	30	8.96	6.79
46 HERTFORD	2	8.44	10	8.38	7.10
47 HOKE	2	8.34	7	6.05	3.39
48 HYDE	1	17.61	3	10.25	8.17
49 IREDELL	1	1.09	34	7.66	6.92
50 JACKSON	0	0.00	12	8.92	7.13
51 JOHNSTON	2	2.47	24	6.15	6.30
52 JONES	0	0.00	6	12.16	8.62
53 LEE	4	9.53	21	10.27	10.52
54 LENOIR	5	8.29	40	13.23	12.15
55 LINCOLN	5	10.29	18	7.75	9.20
56 MCDOWELL	10	27.51	26	14.33	10.80
57 MACON	4	17.09	12	10.38	4.78
58 MADISON	1	5.80	6	6.95	4.02
59 MARTIN	2	7.57	11	8.29	8.43
60 MECKLENBURG	24	5.04	138	6.08	7.04
61 MITCHELL	0	0.00	6	8.25	4.27
62 MONTGOMERY	0	0.00	6	5.01	4.11
63 MOORE	5	8.42	47	16.66	12.50
64 NASH	3	4.12	19	5.31	5.73
65 NEW HANOVER	11	9.36	56	9.81	10.63
66 NORTHAMPTON	3	13.56	24	21.42	15.69
67 ONSLOW	1	0.79	21	3.39	9.40
68 ORANGE	7	7.91	41	9.70	12.52
69 PAMLICO	1	9.10	3	5.49	3.66
70 PASQUOTANK	3	9.77	8	5.33	4.19
71 PENDER	3	11.07	8	6.30	7.06
72 PERQUIMANS	8	72.50	23	43.80	30.57
73 PERSON	1	3.18	12	7.82	7.38
74 PITT	5	4.90	23	4.68	6.29
75 POLK	2	13.58	12	16.50	7.23
76 RANDOLPH	1	0.97	21	4.23	5.08
77 RICHMOND	5	10.90	29	12.69	11.02
78 ROBESON	11	10.18	60	11.25	12.96
79 ROCKINGHAM	1	1.15	26	6.07	5.75
80 ROWAN	14	13.14	87	16.70	12.46
81 RUTHERFORD	3	5.18	44	15.39	11.71
82 SAMPSON	4	7.85	12	4.75	3.67
83 SCOTLAND	2	5.76	16	9.40	12.03
84 STANLY	6	11.75	33	13.10	12.28
85 STOKES	1	2.74	14	7.83	7.30
86 SURRY	3	4.83	35	11.41	9.33
87 SWAIN	2	19.01	8	15.03	9.37
88 TRANSYLVANIA	1	3.81	21	16.36	15.83
89 TYRRELL	1	24.42	1	4.86	3.77 *
90 UNION	1	1.19	13	3.24	3.90
91 VANCE	1	2.54	4	2.06	1.54
92 WAKE	7	1.80	76	4.17	5.92
93 WARREN	3	18.04	8	9.70	5.65
94 WASHINGTON	1	6.83	8	10.99	12.38
95 WATAUGA	0	0.00	11	6.40	4.70
96 WAYNE	4	4.05	41	8.34	10.70
97 WILKES	3	4.88	20	6.56	6.52
98 WILSON	10	15.24	31	9.55	10.26
99 YADKIN	1	3.29	6	4.04	2.65
100 YANCEY	2	12.49	7	8.87	5.23

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

REFERENCES FOR SECTION IV

1. Levy, R.I.; Moskowitz, J. "Cardiovascular Research: Decades of Progress, A Decade of Promise," _Science_. Volume 217, July 9, 1982, pp. 121-129.

2. National Center for Health Statistics. "Advance Report of Final Mortality Statistics, 1987," _Monthly Vital Statistics Report_. Volume 38, Number 5 supp., Hyattsville, Maryland: Public Health Service, September 26, 1989.

3. Centers for Disease Control. "Chronic Disease Reports: Coronary Heart Disease Mortality - United States, 1986," _Morbidity and Mortality Weekly Report_. Vol. 38, Massachusetts Medical Society, Waltham, Ma. 1989, pp. 285-286.

4. National Center for Health Statistics. _Health, United States, 1988_. DHHS Pub. No. (PHS) 89-1232. Public Health Service. Washington, U.S. Government Printing Office, March 1989.

5. Reilly, I.A.; Fitzgerald, G.A. "Aspirin in Cardiovascular Disease," _Drugs_. Vol. 35, No. 2. February 1988, pp. 154-76.

6. North Carolina Department of Human Resources, State Center for Health Statistics. _Leading Causes of Mortality: North Carolina Vital Statistics, Volume 2, 1981_. Raleigh, September 1983.

7. Centers for Disease Control. "Chronic Disease Reports: Stroke - United States, 1986," <u>Morbidity and Mortality Weekly Report</u>. Vol. 38, Massachusetts Medical Society, Waltham, Ma. 1989, pg. 193.

8. Tyroler, H.A.; Haynes, S. "Community Cardiovascular Surveillance Program: Phase II-Protocol," Unpublished Paper. Department of Epidemiology, School of Public Health, UNC-Chapel Hill, N.C., April 1982.

V. CANCER MORTALITY

ACKNOWLEDGEMENTS

CANCER

A recent article in the New England Journal of Medicine (1)
asserted that, despite years of work and millions of dollars for
research, there has been little progress against cancer. The
main evidence in favor of this viewpoint is that cancer is still
the second leading cause of mortality in the United States, and
it is the only major illness which causes more deaths today than
it did in 1950. The article stimulated quite a bit of debate in
the scientific and lay press, and most observers concluded that
it is a complex issue which cannot be reduced to generalizations.
However, at least these considerations should be kept in mind as
one evaluates the viewpoint of the referenced article:

1) For lung cancer, which is the most frequently occurring type
   of cancer in men and now the leading cause of cancer death
   in American women, the survival picture is dismal. The
   large proportion of cancer victims experiencing poor surviv-
   al creates the statistical "evidence" that no progress is
   being made.

2) Other leading causes of death are declining in the United
   States, e.g., heart disease and cerebrovascular disease (1).
   As these causes of death claim fewer and fewer lives, per-
   sons survive longer, leaving a substantially larger pool of
   individuals at higher risk for cancer than previously exist-
   ed. This phenomenon of "competing causes of death" is one
   reason for the absence of a decline in U.S. cancer mortality
   since 1950.

It is also apparent that progress with one form of cancer or in one geographic location is easily hidden by worsening results elsewhere. Furthermore, to really answer the question, the incidence trends for different cancers and survival figures after treatment as well as mortality data must be examined. However, mortality is still the bottom line. In 1986, the National Cancer Institute set a goal to reduce cancer mortality by 50 percent before the year 2000 (1). The data in this volume can be used to measure how far we must go to achieve this goal.

In addition to measuring progress, the data presented here may suggest strategies which could be used to reduce cancer mortality. There are two possible ways to make progress against cancer: to make new discoveries or develop new technology and to apply current knowledge and technology more effectively. Where the data show a marked difference in mortality between two geographical areas for a certain cancer, attempts should be made to identify reasons for the discrepancy. It is likely that methods may be found to better apply existing knowledge to lower the mortality in the higher area. Thus, the data in the following pages not only measure our progress toward the goal of reducing cancer mortality, but also provide clues as to how this goal may be achieved.

In 1988, a total of 12,700 North Carolinians died from cancer. These deaths represent 22 percent of the state's deaths, the same proportion observed in the U.S. (2). The 1988 cancer death rate was 195.8 deaths per 100,000 population, an increase of 3.5 percent over the 1987 rate. However, the state's age-adjusted cancer death rate rose less than 1.1 percent in 1988.

The state's 1984-88 age-adjusted cancer death rate was two percent higher than that for the five-year period 1979 -83. Comparisons of the age-adjusted rate changes for race-sex groups reveal increases of about five percent for all but white males whose rate declined slightly.

5-4

The number of cancer deaths in North Carolina begins to increase at ages 35-44 and peaks at ages 75-84. The death rate peaks in the 85 and older category except among nonwhite males whose rate is highest at ages 75-84. A recent study concerning the health of the elderly in North Carolina found an increase in cancer rates for all age, race, and sex groups over 65, especially nonwhite males, between 1968-72 and 1983-87 (3).

In 1987, the state's age-adjusted cancer death rate was 0.3 percent higher than that for the United States. The rate for N.C. white females was 9.5 percent lower while rates for the other race-sex groups were all higher. The rate for N.C. nonwhite males was more than 16 percent higher than the corresponding U.S. rate. (4)

An interesting criterion for evaluating the impact of cause-specific mortality is the measure "years-of-life-lost," i.e., the loss in years of expected survival due to "early" death. Years-of-life-lost (YLL) cancer rates in North Carolina in 1988 reveal that for white females cancer had the highest overall YLL due largely to the fact that white females have the highest life expectancy of all the race-sex groups. Cancer ranked second or third in YLL for each of the other race-sex groups.

GEOGRAPHIC PATTERNS

Unadjusted and age-race-sex-adjusted county death rates for 1984-88 are mapped in Figures 5.A and 5.B respectively. For this five-year period, as in the past, high unadjusted rates were more prevalent among western and eastern counties with relatively low rates occurring in the southcentral portion of the state. However, these differences are due largely to age-race-sex differences since adjustment for these factors considerably changes the mortality picture. The western counties' rates are

generally lower while the high rates, although diminished, remain
in the eastern counties.

Based on procedures described in Section II, the following
map reveals several statistically significant clusters of coun-
ties with high unadjusted rates. These clusters are located in
northeastern and western North Carolina, and are similar to
clusters of unadjusted county rates observed in 1979-81 (5).
After adjustment for age, race, and sex, there were no statisti-
cally significant clusters of high-rate counties. Hence, clus-
tering of high-rate counties reflects variations in age, race,
and/or sex among the populations of these counties. In contrast,
in the 1979-81 period there were two small clusters of three and
four counties (based on adjusted rates) in the eastern part of
the state (5).

CANCER - ALL SITES

MORTALITY RATES PER 100,000 POPULATION
■ 225.88 to 292.23 (p<=.01)
□ 96.83 to 224.73

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
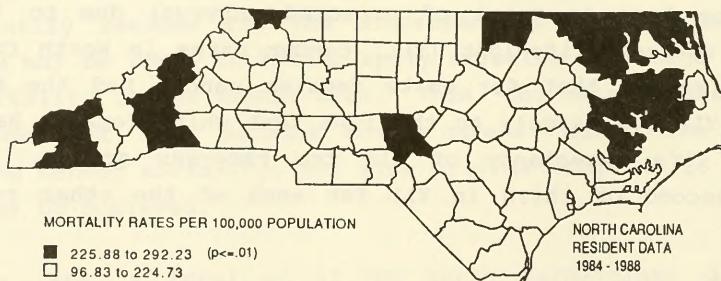
SITE-SPECIFIC CANCER

This report is designed to address mortality patterns for
several cancers that are leading causes of death (lung,
colorectal, breast, and prostate). Other cancers previously
reported in this volume are not included this year due to growing
concern about instability of the county death rates (due to the
relatively small numbers of deaths involved). A separate
report will be forthcoming on these more rare cancers.

5-6

M O R T A L I T Y   S T A T I S T I C S   F O R   1 9 8 8

N O R T H   C A R O L I N A   R E S I D E N T S

C A N C E R - A L L   S I T E S

GEOGRAPHICAL AREA	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
NORTH CAROLINA	12700	195.76	58216	183.98	183.98
REGIONS					
DHR I WESTERN	4487	201.79	20567	189.79	181.61
DHR II N. CENTRAL	2710	198.77	12647	189.60	180.00
DHR III S. CENTRAL	2657	173.34	12032	162.02	185.02
DHR IV EASTERN	2846	208.07	12970	193.34	194.67
HSA I WESTERN	2368	216.13	10703	198.50	178.89
HSA II PIEDMONT	2382	198.23	11051	187.80	181.56
HSA III S. PIEDMONT	2119	187.86	9864	181.17	184.82
HSA IV CAPITAL	1698	175.13	7776	167.92	182.22
HSA V CAROINAL	1832	188.27	8380	175.38	191.46
HSA VI EASTERN	2301	205.49	10442	189.45	191.73
COUNTIES					
1 ALAMANCE	231	218.12	1074	207.51	177.07
2 ALEXANDER	34	123.35	169	125.57	146.13
3 ALLEGHANY	24	244.42	117	239.47	189.04
4 ANSON	42	160.06	251	191.39	168.05
5 ASHE	51	217.13	243	208.19	197.93
6 AVERY	28	183.55	128	169.80	183.71
7 BEAUFORT	117	275.73	479	226.35	194.98
8 BERTIE	50	237.66	250	235.84	185.41
9 BLADEN	62	200.43	294	190.77	176.00
10 BRUNSWICK	108	211.94	509	214.33	202.05
11 BUNCOMBE	415	239.61	1918	225.88	192.26
12 BURKE	165	213.42	622	163.59	167.52
13 CABARRUS	184	191.78	934	199.83	184.10
14 CALDWELL	143	200.13	632	179.78	187.16
15 CAMDEN	15	247.64	67	226.83	207.63
16 CARTERET	126	246.87	528	214.34	205.71
17 CASWELL	40	180.23	192	172.63	158.30
18 CATAWBA	219	186.62	1003	175.78	184.25
19 CHATHAM	77	209.60	337	187.81	164.83
20 CHEROKEE	49	231.28	206	200.66	166.23
21 CHOWAN	45	328.58	195	292.22	215.03
22 CLAY	17	233.70	86	240.52	183.91
23 CLEVELAND	193	221.54	850	197.56	188.03
24 COLUMBUS	109	207.37	497	189.99	178.37
25 CRAVEN	129	158.10	593	148.48	180.38
26 CUMBERLAND	316	124.10	1445	113.39	195.77
27 CURRITUCK	44	314.57	163	243.39	231.98
28 DARE	58	270.27	197	210.35	187.13
29 DAVIDSON	242	194.69	1073	176.90	181.33
30 DAVIE	72	258.56	277	205.53	217.70
31 DUPLIN	85	204.06	446	214.37	167.85
32 DURHAM	340	198.27	1572	190.05	195.94
33 EDGECOMBE	146	243.79	606	205.70	195.59
34 FORSYTH	489	183.59	2415	185.11	179.55
35 FRANKLIN	61	172.09	310	183.29	151.77
36 GASTON	354	203.22	1591	185.12	189.05
37 GATES	24	245.14	132	277.05	213.36
38 GRAHAM	19	270.77	83	232.72	172.45
39 GRANVILLE	62	159.07	330	175.83	148.51
40 GREENE	31	189.18	130	157.71	157.29
41 GUILFORD	672	199.50	3165	191.65	189.24

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

COUNTIES (CONT'D)	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
42 HALIFAX	124	218.15	587	208.56	170.86
43 HARNETT	153	230.81	619	193.15	207.20
44 HAYWOOD	114	236.17	536	223.00	179.24
45 HENDERSON	201	290.21	826	246.77	178.12
46 HERTFORD	65	274.62	273	228.92	186.46
47 HOKE	43	179.36	159	137.49	177.46
48 HYDE	9	158.53	70	239.35	199.86
49 IREDELL	176	192.15	832	187.46	173.15
50 JACKSON	46	170.05	216	160.63	152.94
51 JOHNSTON	159	197.11	720	184.55	177.92
52 JONES	25	253.88	100	202.82	156.24
53 LEE	85	202.67	377	184.50	187.00
54 LENOIR	124	205.66	623	206.21	188.85
55 LINCOLN	75	154.35	376	162.01	164.71
56 MCDOWELL	86	236.64	348	191.83	179.98
57 MACON	73	311.91	299	258.78	217.88
58 MADISON	45	261.14	175	202.94	222.40 *
59 MARTIN	56	211.98	267	201.43	179.22
60 MECKLENBURG	820	172.25	3833	168.91	190.63
61 MITCHELL	32	217.70	167	229.72	141.80
62 MONTGOMERY	50	206.85	230	192.07	173.21
63 MOORE	171	288.28	723	256.40	194.47
64 NASH	144	197.96	670	187.57	183.07
65 NEW HANOVER	267	227.39	1237	216.70	225.15
66 NORTHAMPTON	47	212.59	264	235.62	194.31
67 ONSLOW	122	97.20	599	96.82	201.14
68 ORANGE	127	143.52	584	138.19	182.86
69 PAMLICO	31	282.33	138	252.81	206.46
70 PASQUOTANK	77	251.01	355	236.70	214.13
71 PENDER	61	225.24	285	224.57	191.63
72 PERQUIMANS	29	262.84	118	224.72	160.55
73 PERSON	56	178.21	280	182.58	164.96
74 PITT	180	176.46	783	159.48	185.09
75 POLK	33	224.15	204	280.55	171.78
76 RANDOLPH	179	174.20	851	171.54	181.64
77 RICHMOND	83	180.98	451	197.48	173.62
78 ROBESON	195	180.52	874	163.97	182.65
79 ROCKINGHAM	183	211.60	840	196.14	181.18
80 ROWAN	239	224.37	1132	217.41	179.34
81 RUTHERFORD	119	205.84	585	204.74	173.95
82 SAMPSON	106	208.28	504	199.53	178.44
83 SCOTLAND	66	190.19	302	177.60	200.23
84 STANLY	127	248.80	520	206.56	183.87
85 STOKES	65	178.14	284	158.92	168.26
86 SURRY	147	236.67	597	194.68	179.96
87 SWAIN	31	294.73	123	231.13	189.19
88 TRANSYLVANIA	58	221.47	278	216.64	206.28
89 TYRRELL	8	195.36	48	233.49	205.52
90 UNION	144	171.41	646	161.37	188.63
91 VANCE	98	249.54	446	230.59	202.13
92 WAKE	582	149.80	2590	142.22	185.72
93 WARREN	51	306.76	230	278.99	205.30
94 WASHINGTON	29	198.10	166	228.14	217.29
95 WATAUGA	55	158.62	225	131.10	148.36
96 WAYNE	205	207.85	933	189.93	207.69
97 WILKES	81	131.86	478	156.93	153.10
98 WILSON	156	237.86	662	204.09	196.60
99 YADKIN	62	204.47	283	190.55	154.88
100 YANCEY	37	231.09	186	235.83	200.84

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

CANCER - ALL SITES

MORTALITY RATES PER 100,000 POPULATION

■	277.05 to 292.23
■	223.00 to 258.78
▨	182.59 to 217.41
▨	156.93 to 179.78
□	125.58 to 148.49
□	96.83 to 113.39

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
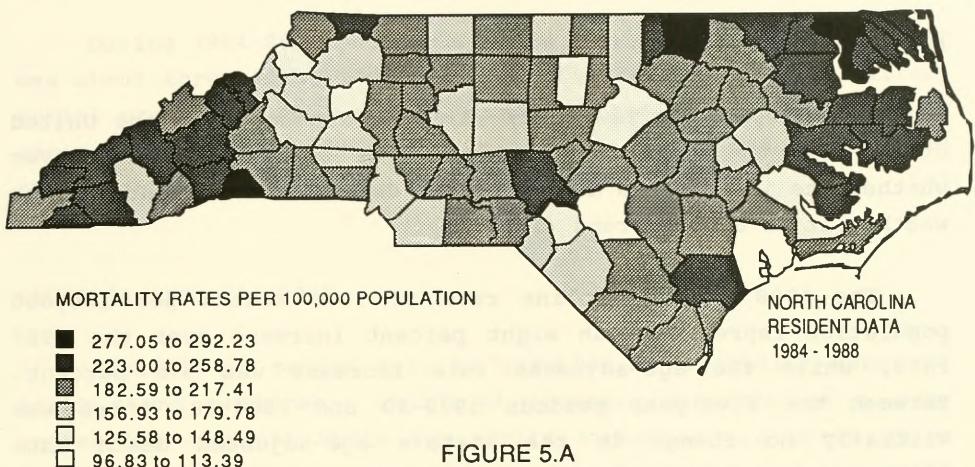
FIGURE 5.A

CANCER - ALL SITES

AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 POPULATION

■	231.98 to 231.98
■	213.36 to 225.15
▨	194.32 to 207.69
▨	176.01 to 192.27
□	164.72 to 173.95
□	141.80 to 160.55

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
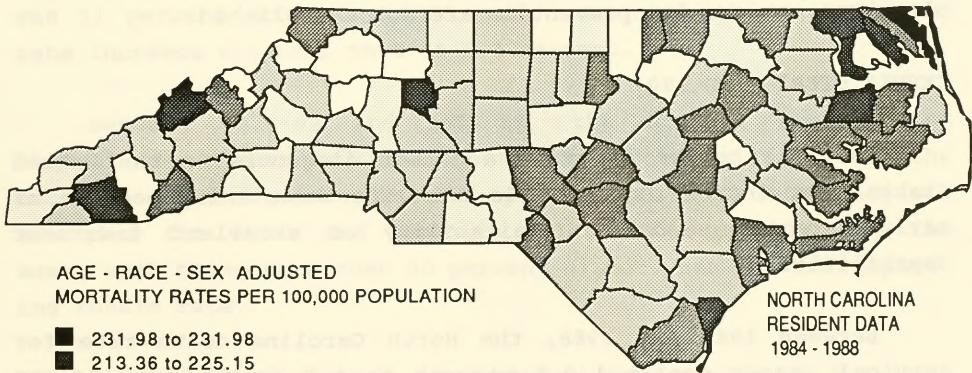
FIGURE 5.B

Meanwhile, because of their substantial public health interest, a brief narrative follows for three of these "rare" cancers: pancreas, uterine cervix, and leukemia.

PANCREAS (ICD 157)

This cancer has been increasing in frequency in the United States for the last two decades (2). Debate continues over whether the increase is due to better detection and reporting, or whether it is a real trend (1).

The 1988 North Carolina rate of 10.3 deaths per 100,000 population represented an eight percent increase over the 1987 rate, while the age-adjusted rate increase was 5.5 percent. Between the five-year periods 1979-83 and 1984-88, there was virtually no change in the state's age-adjusted death rate although nonwhite males and females experienced small increases.

During 1984-88, the age-adjusted death rates for nonwhite males and females were approximately 50 percent higher than the corresponding rates for whites. This race differential warrants close public health attention and surveillance; unfortunately, clear-cut options for prevention are not established.

CERVIX UTERI (ICD 180)

Cervical cancer is still a common diagnosis in the United States; yet increasingly, it is not life-threatening because of early detection and the availability of excellent treatment capabilities.

Between 1987 and 1988, the North Carolina death rate for cervical cancer declined 2.8 percent to 4.2 deaths per 100,000 population. The age-adjusted rate declined 3.5 percent. Between

5-10

1979-83 and 1984-88, the age-adjusted rate declined approximately 12 percent; the decline was approximately 20 percent for non-whites compared to 10 percent for whites.

During 1984-88, the age-adjusted nonwhite female death rate was about three times that for white females. This wide differential probably involves late access to health care and perhaps socioeconomic and sexual activity factors often associated with the disease.

LEUKEMIA (ICD 204-208)

Leukemia is second only to injuries as a leading cause of death among children. Childhood leukemia presents as a very aggressive disease, while for adults leukemias are often quite indolent processes. Risk factors for leukemia are generally environmental and occupational. Leukemia is managed primarily with chemotherapy; today the prognosis is quite good for early diagnoses.

North Carolina's leukemia death rate in 1988 was 7.0, which was 11 percent above the 1987 rate. However, the age-adjusted rate increase was half that at 5.5 percent.

Between 1979-83 and 1984-88, the state's age-adjusted leukemia death rate declined about nine percent with most of the decrease occurring among whites. During 1984-88, the age-adjusted rates for white and nonwhite males were approximately the same, each being more than 50 percent higher than the corresponding female rate.

In 1987, the state's age-adjusted leukemia death rate was eight percent below the nation's. However, the rate for North Carolina's nonwhite males was 15 percent higher than the corresponding U.S. rate. (4)

NOTE: Due to ready availability, the 1979-83 and 1984-88
         age-adjusted death rates examined for the above
         site-specific cancers used the 1970 U.S. Census
         population as the standard for direct age-adjustment.
         Other age-adjusted rates examined in this report use the
         1940 U.S. Census as the standard, following the
         convention of the National Center for Health
         Statistics. In terms of percent differences over time
         and between race-sex groups, the two standards yield
         generally similar results.

CANCER OF THE COLON AND RECTUM

Colorectal cancer is the second leading cause of cancer death in North Carolina, exceeded only by lung cancer. The marked geographic differences in incidence for this cancer, and the fact that incidence rates change with migration, suggest that there may be important environmental determinants. It might be possible to prevent a substantial proportion of colorectal cancer if these factors could be identified and modified. A variety of risk factors for the disease have been examined.

Many studies have explored the relationship between diet and colorectal cancer. A high-fiber, low-fat diet is thought by some to protect against large bowel cancer, although studies have had somewhat contradictory results (6,7). Other dietary factors that may be protective include calcium, cruciferous vegetables (broccoli, cabbage, Brussels sprouts), vitamin A, beta carotene, garlic and onions (8,9).

There is no consistent association with occupation apart from above-average risk among professional and administrative workers. There have been reports of increased rates in woodworkers, pattern makers, synthetic fiber workers, and asbestos workers. Physical activity, both avocational and occupational, may decrease risk. (10) Individuals with a first-degree relative with colon cancer appear to be three times more likely to develop the disease themselves. Recent molecular studies have identified specific genetic abnormalities in some colon cancers. (11)

Colon cancers that are discovered early are more amenable to surgical cure. Although there are techniques available to screen for colon cancer, they have not been convincingly demonstrated to confer a survival advantage to those screened. Because screening programs are expensive, our best hope to decrease the burden of suffering from colon cancer is through prevention. The data available from epidemiologic studies suggest that such prevention may be feasible.

Based on data collected between 1979 and 1984, the five-year survival rates for colon cancer were 54 percent for whites, 49 percent for blacks, and 53 percent overall (2).

In 1988, a total of 1,331 North Carolinians died of colorectal cancer. This accounted for 10.5 percent of the state's cancer deaths and 2.3 percent of all deaths. The mortality rate in 1988 was 20.5 deaths per 100,000 population. This was a 2.5 percent increase over the 1987 mortality rate of 20.0. However, after adjustment for age, there was a three percent decrease between 1987 and 1988.

The five-year age-adjusted mortality rate (1984-88) was the same as that of the preceding five-year period (1979-83). There was a slight decrease for whites (males and females) and increases of 5.4 and 12.5 percent respectively for nonwhite males and females. In 1986 North Carolina had the thirty-second highest age-adjusted mortality rate in the nation (12).

In North Carolina colon cancer deaths are not often found prior to age 45, and the death rate is highest at ages 85 and older (3). This holds true for both sexes and races. The age-adjusted colorectal cancer death rate for race-sex groups reveal higher rates among nonwhites, but the race differentials are relatively small. This suggests that environmental determinants are largely non-occupational.

5-14

More than any other site-specific cancer mortality rates examined in this report, North Carolina's higher county-level colon/rectum cancer rates tend to cluster to a statistically significant degree, following the procedures described in Section II. When mapped, the high unadjusted rates reveal northeastern, central, and southwestern clusters as shown in the first text map below.

CANCER - COLON, RECTUM AND ANUS

MORTALITY RATES PER 100,000 POPULATION

■ 27.28 to 40.30 (p<=.01)
■ 24.14 to 26.39 (p<=.05)
□ 9.86 to 23.89

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
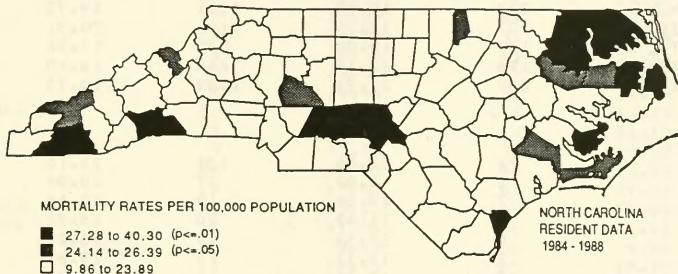
As shown in the age-race-sex-adjusted text map below, significant clusters of high-rate counties are found in the east-northeast and central portions of the state. Health offi-cials should be particularly aware of these areas with high colon/rectum cancer mortality over and above that due to age, race, and sex factors. Counties not identified in the text maps should consult Figures 6.A and 6.B to ascertain their relative levels of mortality from colorectal cancer.

CANCER - COLON, RECTUM AND ANUS

AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 POPULATION

■ 23.77 to 49.03 (p<=.05)
□ 8.42 to 23.49

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
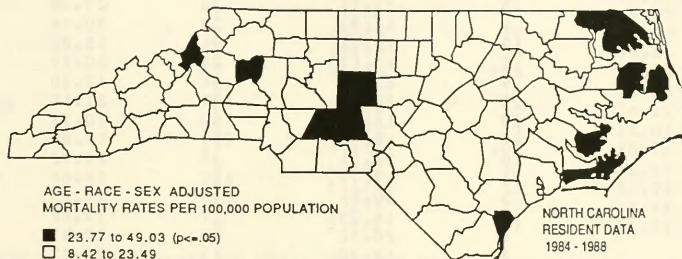
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                              T A B L E - 7

              M O R T A L I T Y   S T A T I S T I C S   F O R   1 9 8 8

                    N O R T H   C A R O L I N A   R E S I D E N T S

                C A N C E R  -  C O L O N ,  R E C T U M  A N D  A N U S
```

GEOGRAPHICAL AREA	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
NORTH CAROLINA	1331	20.51	6206	19.61	19.61
REGIONS					
DHR I WESTERN	473	21.27	2261	20.86	19.77
DHR II N. CENTRAL	276	20.24	1323	19.83	18.76
DHR III S. CENTRAL	292	19.04	1255	16.89	19.23
DHR IV EASTERN	290	21.20	1367	20.37	20.80
HSA I WESTERN	266	24.27	1155	21.42	19.32
HSA II PIEDMONT	238	19.80	1161	19.73	19.03
HSA III S. PIEDMONT	207	18.35	1106	20.31	20.69
HSA IV CAPITAL	185	19.03	830	17.92	19.29
HSA V CARDINAL	196	20.14	865	18.10	19.75
HSA VI EASTERN	239	21.34	1089	19.75	20.28
COUNTIES					
1 ALAMANCE	24	22.66	123	23.76	20.18
2 ALEXANDER	1	3.62	27	20.06	24.26
3 ALLEGHANY	2	20.36	10	20.46	12.92
4 ANSON	3	11.43	20	15.25	11.89
5 ASHE	6	25.54	19	16.27	17.95 *
6 AVERY	2	13.11	15	19.89	49.03 *
7 BEAUFORT	10	23.56	42	19.84	16.98
8 BERTIE	10	47.53	29	27.35	21.20
9 BLADEN	8	25.86	29	18.81	18.01
10 BRUNSWICK	9	17.66	50	21.05	20.82
11 BUNCOMBE	38	21.94	197	23.20	19.56
12 BURKE	15	19.40	60	15.78	15.09
13 CABARRUS	21	21.88	106	22.67	20.35
14 CALDWELL	18	25.19	58	16.49	16.77
15 CAMDEN	1	16.50	9	30.47	26.43
16 CARTERET	9	17.63	65	26.38	26.64
17 CASWELL	5	22.52	21	18.88	20.58
18 CATAWBA	29	24.71	119	20.85	22.07
19 CHATHAM	8	21.77	41	22.84	19.56
20 CHEROKEE	4	18.88	19	18.50	13.24
21 CHOWAN	5	36.50	19	28.47	19.97
22 CLAY	0	0.00	12	33.56	19.75
23 CLEVELAND	26	29.84	100	23.24	22.13
24 COLUMBUS	7	13.31	37	14.14	13.29
25 CRAVEN	16	19.61	60	15.02	18.13
26 CUMBERLAND	40	15.70	146	11.45	20.61
27 CURRITUCK	5	35.74	16	23.89	22.16
28 DARE	9	41.93	29	30.96	29.77
29 DAVIDSON	19	15.28	96	15.82	15.76
30 DAVIE	7	25.13	28	20.77	22.45
31 DUPLIN	9	21.60	36	17.30	14.77
32 DURHAM	36	20.99	175	21.15	21.16
33 EDGECOMBE	10	16.69	60	20.36	18.59
34 FORSYTH	49	18.39	259	19.85	19.05
35 FRANKLIN	10	28.21	32	18.92	14.11
36 GASTON	31	17.79	160	18.61	18.59
37 GATES	3	30.64	13	27.28	24.13
38 GRAHAM	1	14.25	7	19.62	13.13
39 GRANVILLE	8	20.52	43	22.91	18.87
40 GREENE	3	18.30	13	15.77	15.75
41 GUILFORD	81	24.04	341	20.64	20.32

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

COUNTIES (CONT'D)	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
42 HALIFAX	11	19.35	52	18.47	16.84
43 HARNETT	16	24.13	58	18.09	19.32
44 HAYWOOD	17	35.21	56	23.29	17.78
45 HENDERSON	24	34.65	112	33.46	21.52
46 HERTFORD	5	21.12	35	29.34	22.70
47 HOKE	4	16.68	12	10.37	13.46
48 HYDE	1	17.61	6	20.51	20.38
49 IREDELL	19	20.74	97	21.85	20.13
50 JACKSON	3	11.09	15	11.15	9.83
51 JOHNSTON	15	18.59	50	12.81	12.72
52 JONES	4	40.62	12	24.33	19.44
53 LEE	6	14.30	39	19.08	18.99
54 LENOIR	17	28.19	72	23.83	23.28
55 LINCOLN	5	10.29	47	20.25	22.63
56 MCDOWELL	9	24.76	38	20.94	23.32
57 MACON	9	38.45	45	38.94	20.12
58 MADISON	5	29.01	12	13.91	8.41
59 MARTIN	7	26.49	32	24.14	21.05
60 MECKLENBURG	72	15.12	414	18.24	20.83
61 MITCHELL	5	34.01	19	26.13	16.01
62 MONTGOMERY	9	37.23	35	29.22	26.94
63 MOORE	26	43.83	83	29.43	21.46
64 NASH	13	17.87	61	17.07	16.34
65 NEW HANOVER	33	28.10	166	29.08	30.43
66 NORTHAMPTON	7	31.66	24	21.42	18.19
67 ONSLOW	12	9.56	61	9.86	23.01
68 ORANGE	15	16.95	65	15.38	20.43
69 PAMLICO	6	54.64	22	40.30	31.94
70 PASQUOTANK	10	32.59	46	30.67	26.94
71 PENDER	2	7.38	25	19.69	18.65
72 PERQUIMANS	5	45.31	18	34.28	24.74
73 PERSON	4	12.72	23	14.99	12.89
74 PITT	16	15.68	76	15.48	17.45
75 POLK	5	33.96	26	35.75	17.22
76 RANDOLPH	14	13.62	108	21.77	23.77
77 RICHMOND	6	13.08	43	18.82	16.69
78 ROBESON	15	13.88	86	16.13	16.59
79 ROCKINGHAM	14	16.18	73	17.04	16.03
80 ROWAN	29	27.22	135	25.92	21.50
81 RUTHERFORD	19	32.86	64	22.39	20.67
82 SAMPSON	12	23.57	50	19.79	17.80
83 SCOTLAND	6	17.29	25	14.70	15.92
84 STANLY	13	25.46	69	27.40	23.79
85 STOKES	5	13.70	22	12.31	12.80
86 SURRY	17	27.37	63	20.54	19.72
87 SWAIN	2	19.01	14	26.30	23.46
88 TRANSYLVANIA	8	30.54	25	19.48	18.24
89 TYRRELL	2	48.84	7	34.05	27.28
90 UNION	17	20.23	78	19.48	22.18
91 VANCE	15	38.19	50	25.85	22.89
92 WAKE	67	17.24	298	16.36	21.60
93 WARREN	1	6.01	14	16.98	11.17
94 WASHINGTON	2	13.66	19	26.11	22.98
95 WATAUGA	5	14.42	19	11.07	10.49
96 WAYNE	17	17.23	102	20.76	23.48
97 WILKES	8	13.02	50	16.41	14.79
98 WILSON	14	21.34	53	16.33	16.20
99 YADKIN	3	9.89	27	18.18	14.10
100 YANCEY	5	31.22	17	21.55	13.91

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

CANCER - COLON, RECTUM AND ANUS

MORTALITY RATES PER 100,000 POPULATION

- 38.95 to 40.30
- 33.46 to 35.76
- 28.47 to 30.97
- 22.40 to 27.41
- 13.92 to 21.85
- 9.86 to 12.82

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
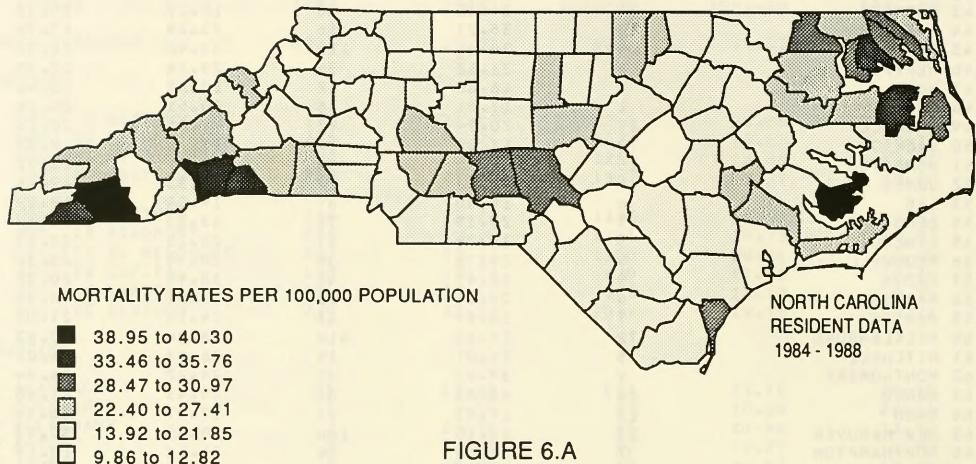
FIGURE 6.A

CANCER - COLON, RECTUM AND ANUS

AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 POPULATION

- 40.03 to 49.03
- 29.77 to 31.95
- 26.43 to 27.29
- 17.79 to 24.74
- 12.73 to 17.46
- 8.42 to 11.89

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
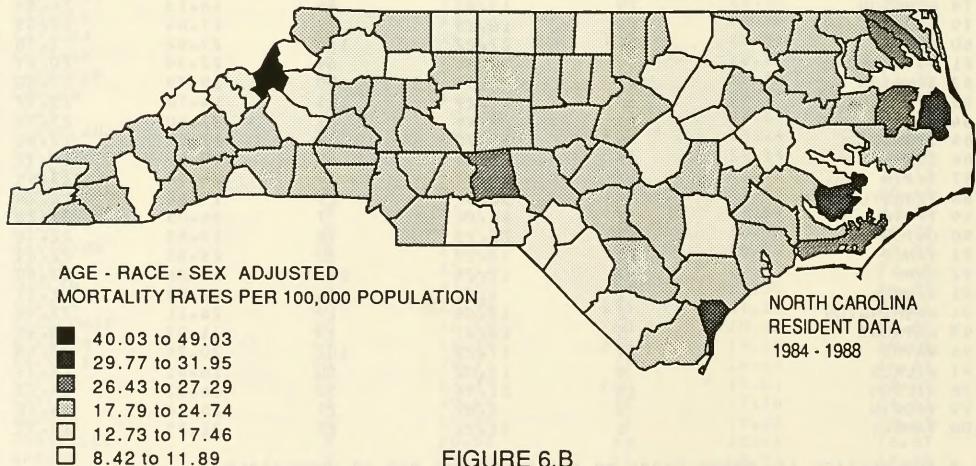
FIGURE 6.B

CANCER OF THE TRACHEA, BRONCHUS, AND LUNG

Lung cancer is the leading cause of cancer death in both men and women in the United States (13). The incidence rate for this cancer continues to increase nationwide in both males and females, black and white. Lung cancer deaths among American women have now surpassed the number of breast cancer deaths. (2) Among North Carolina residents in 1988 there were 1,058 female deaths due to lung cancer while 1,093 women died of breast cancer. Thus, lung cancer deaths among women are rapidly approaching the number due to breast cancer. This increase in deaths is larger than for any other cancer site. There have been increases in both incidence and death for every group with women increasing more rapidly. (14)

In 1988, a total of 3,669 North Carolinians died from lung cancer. This accounted for 28.9 percent of the state's cancer deaths and 6.4 percent of all deaths. The mortality rate in 1988 was 56.6 deaths per 100,000 population. This was a six percent increase over the 1987 mortality rate; however, the age-adjusted rate increase was a third lower at 3.9 percent.

The five-year age-adjusted mortality rate (1984-88) was 12.2 percent higher than that for the preceding five-year period (1979-83). All race-sex groups experienced increases over this time period, with the greatest increase in white females whose rate rose by one-third. In 1986, North Carolina had the 27th highest age-adjusted mortality rate in the nation (15). This North Carolina rate was 0.6% less than that for the U. S.

During 1984-88, North Carolina's age-adjusted death rates were over three times higher for white males than for white females and almost six times higher for nonwhite males than for nonwhite females. Thus, there is a wide sex differential in mortality risk. The 1984-88 nonwhite male rate was 23 percent higher than that for white males, while the nonwhite female rate was 31 percent below that for white females.

In North Carolina, lung cancer deaths are not generally found prior to age 45 with the number of deaths peaking at ages 65-74. The death rate also peaks at ages 65-74 except among white males whose peak occurs at ages 75-84 (3).

Lung cancer is very difficult to detect early since symptoms often don't appear until the disease has advanced considerably. Only 24 percent of lung cancer cases are detected at the early (localized) stage. For this reason, only 13 percent of lung cancer patients (all stages, whites and blacks) live five or more years after diagnosis. (13)

The major risk factor for the development of lung cancer is cigarette smoking. Tobacco is responsible for 83 percent of lung cancer cases overall, 85 percent among men and 75 percent among women (16). To date, 43 chemicals in tobacco smoke have been determined to be carcinogenic (13).

Certain industrial substances such as asbestos, radon decay products, and other risk factors for lung cancer have been found to interact with smoking to produce even higher risk estimates (17). Air pollution has been estimated to be the cause of 1 to 2 percent of lung cancer cases (18). Indoor air pollution, mainly in the form of tobacco smoke and radon, have been linked causally to lung cancer (6). Diet has recently been considered as potentially influencing the risk of lung cancer in smokers, in particular deficiencies in vitamin A, carotene, vitamin E, and vitamin

C (19). Clinical trials on vitamin A and lung cancer risk are now in progress. Finally, exposure to radiation and familial factors have been suggested to affect lung cancer risk (18).

GEOGRAPHIC PATTERNS

During 1984-88 residents of eastern North Carolina experienced higher lung cancer mortality prior to and after adjustment for age, race and sex distribution (Figures 7.A and 7.B, respectively). However, there were no statistically significant clustering patterns. This contrasts sharply with significant clustering of the unadjusted and adjusted rates during 1979-81 (5).

TABLE - 5

MORTALITY STATISTICS FOR 1988

NORTH CAROLINA RESIDENTS

CANCER - TRACHEA, BRONCHUS AND LUNG

GEOGRAPHICAL AREA	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
NORTH CAROLINA	3669	56.55	16344	51.65	51.65
REGIONS					
DHR I WESTERN	1275	57.34	5737	52.94	49.73
DHR II N. CENTRAL	779	57.13	3465	51.94	49.20
DHR III S. CENTRAL	789	51.47	3412	45.94	53.64
DHR IV EASTERN	826	60.39	3730	55.60	57.57
HSA I WESTERN	639	58.32	2917	54.10	47.33
HSA II PIEDMONT	694	57.75	3011	51.16	49.10
HSA III S. PIEDMONT	636	56.38	2820	51.79	52.25
HSA IV CAPITAL	482	49.71	2180	47.07	52.64
HSA V CARDINAL	563	57.86	2439	51.04	56.69
HSA VI EASTERN	655	58.49	2977	54.01	56.64
COUNTIES					
1 ALAMANCE	70	66.09	301	58.15	48.28
2 ALEXANDER	11	39.90	41	30.46	30.57
3 ALLEGHANY	5	50.92	37	75.73	68.87 *
4 ANSON	14	53.35	77	58.71	52.51
5 ASHE	9	38.31	65	55.69	49.95
6 AVERY	8	52.44	47	62.35	47.75
7 BEAUFORT	30	70.70	133	62.85	57.09
8 BERTIE	9	42.77	63	59.43	48.34
9 BLADEN	19	61.42	86	55.80	51.40
10 BRUNSWICK	36	70.64	172	72.42	65.25
11 BUNCOMBE	116	66.97	539	63.47	53.97
12 BURKE	48	62.08	179	47.08	44.28
13 CABARRUS	49	51.07	261	55.84	51.53
14 CALDWELL	53	74.17	173	49.21	45.02
15 CAMDEN	6	99.05	19	64.32	57.53
16 CARTERET	44	86.21	170	69.01	61.44
17 CASWELL	13	58.57	46	41.36	36.12
18 CATAWBA	62	52.83	290	50.82	50.09
19 CHATHAM	29	78.94	106	59.07	52.90
20 CHEROKEE	10	47.20	60	58.44	61.64
21 CHOWAN	12	87.62	52	77.92	60.18
22 CLAY	3	41.24	18	50.34	27.18
23 CLEVELAND	45	51.65	220	51.13	48.32
24 COLUMBUS	38	72.29	157	60.01	57.18
25 CRAVEN	39	47.80	150	37.56	46.65
26 CUMBERLAND	111	43.59	467	36.64	64.13
27 CURRITUCK	19	135.84	60	89.59	83.16
28 DARE	18	83.87	63	67.26	61.09
29 DAVIDSON	66	53.09	284	46.82	45.92
30 DAVIE	17	61.05	57	42.29	44.73
31 DUPLIN	22	52.81	119	57.19	51.53
32 DURHAM	85	49.56	415	50.17	56.02
33 EDGECOMBE	40	66.79	168	57.02	60.21
34 FORSYTH	134	50.30	645	49.43	48.51
35 FRANKLIN	18	50.78	102	60.31	52.88
36 GASTON	122	70.03	505	58.76	59.28
37 GATES	7	71.50	42	88.15	68.68
38 GRAHAM	5	71.25	28	78.50	57.72
39 GRANVILLE	16	41.05	91	48.48	44.84
40 GREENE	12	73.23	51	61.87	67.14
41 GUILFORD	183	54.32	867	52.49	52.16

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

MORTALITY STATISTICS FOR 1988, NORTH CAROLINA RESIDENTS
CANCER - TRACHEA, BRONCHUS AND LUNG CONT'D.

	COUNTIES (CONT'D)	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
42	HALIFAX	33	58.05	172	61.11	56.66
43	HARNETT	45	67.88	162	50.55	54.46
44	HAYWOOD	32	66.29	151	62.82	43.08
45	HENDERSON	47	67.86	203	60.64	45.47
46	HERTFORD	24	101.39	79	66.24	60.55
47	HOKE	16	66.74	56	48.42	65.50
48	HYDE	3	52.84	22	75.22	64.49
49	IREDELL	46	50.22	213	49.11	43.73
50	JACKSON	11	40.66	52	38.67	36.63
51	JOHNSTON	47	58.26	223	57.16	54.49
52	JONES	9	91.39	27	54.76	43.62
53	LEE	28	66.76	105	51.38	52.52
54	LENOIR	38	63.02	196	64.87	60.44
55	LINCOLN	26	53.51	103	44.38	46.99
56	MCDOWELL	26	71.54	104	57.33	47.71
57	MACON	15	64.09	67	57.98	57.77
58	MADISON	13	75.44	44	51.02	54.74 *
59	MARTIN	15	56.78	75	56.58	52.16
60	MECKLENBURG	248	52.09	1115	49.13	56.21
61	MITCHELL	7	47.62	44	60.52	37.03
62	MONTGOMERY	15	62.05	55	45.93	41.60
63	MOORE	52	87.66	207	73.41	55.13
64	NASH	38	52.24	186	52.07	51.53
65	NEW HANOVER	75	63.87	350	61.31	63.68
66	NORTHAMPTON	12	54.27	56	49.98	44.24
67	ONSLOW	42	33.46	180	29.09	58.74
68	ORANGE	34	38.42	147	34.78	47.10
69	PAMLICO	8	72.85	42	76.94	63.41
70	PASQUOTANK	23	74.97	109	72.67	68.43
71	PENDER	22	81.23	74	58.31	50.73
72	PERQUIMANS	6	54.38	29	55.22	41.23
73	PERSON	12	38.18	80	52.16	47.53
74	PITT	54	52.93	217	44.20	54.66
75	POLK	9	61.13	49	67.38	46.26
76	RANDOLPH	60	58.39	237	47.77	45.72
77	RICHMOND	22	47.97	118	51.67	46.76
78	ROBESON	53	49.06	255	47.84	59.67
79	ROCKINGHAM	68	78.62	233	54.40	50.30
80	ROWAN	62	58.20	294	56.46	45.44
81	RUTHERFORD	20	34.59	152	53.19	44.76
82	SAMPSON	33	64.84	137	54.23	49.83
83	SCOTLAND	12	34.58	66	38.81	45.97
84	STANLY	38	74.44	136	54.02	50.37
85	STOKES	20	54.81	89	49.80	57.64
86	SURRY	48	77.28	187	60.98	57.00
87	SWAIN	9	85.56	28	52.61	45.54
88	TRANSYLVANIA	19	72.55	76	59.22	59.97
89	TYRRELL	3	73.26	18	87.56	85.10
90	UNION	45	53.56	188	46.96	54.91
91	VANCE	26	66.20	123	63.59	60.81
92	WAKE	174	44.78	730	40.08	53.43
93	WARREN	13	78.19	58	70.35	62.40
94	WASHINGTON	9	61.47	42	57.72	53.52
95	WATAUGA	18	51.91	56	32.62	41.58
96	WAYNE	47	47.65	261	53.13	60.14
97	WILKES	25	40.69	140	45.96	45.92
98	WILSON	33	50.31	176	54.26	54.94
99	YADKIN	15	49.46	65	43.76	33.41
100	YANCEY	13	81.19	54	68.46	45.58

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

DIVISION OF STATISTICS AND INFORMATION SERVICES
DEPARTMENT OF ENVIRONMENT, HEALTH AND NATURAL RESOURCES

CANCER - TRACHEA, BRONCHUS AND LUNG

MORTALITY RATES PER 100,000 POPULATION

- ■ 87.56 to 89.59
- ▨ 66.25 to 78.51
- ▧ 54.02 to 64.88
- ▨ 45.93 to 53.20
- □ 36.65 to 44.38
- □ 29.10 to 34.78

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
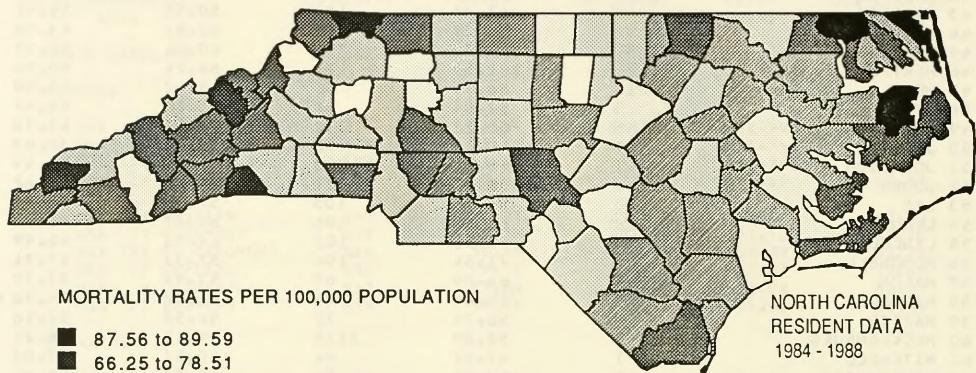
FIGURE 7.A

CANCER - TRACHEA, BRONCHUS AND LUNG

AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 POPULATION

- ■ 83.17 to 85.11
- ▨ 58.74 to 68.88
- ▧ 49.83 to 57.77
- ▨ 41.24 to 48.52
- □ 30.58 to 37.04
- □ 27.19 to 27.19

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
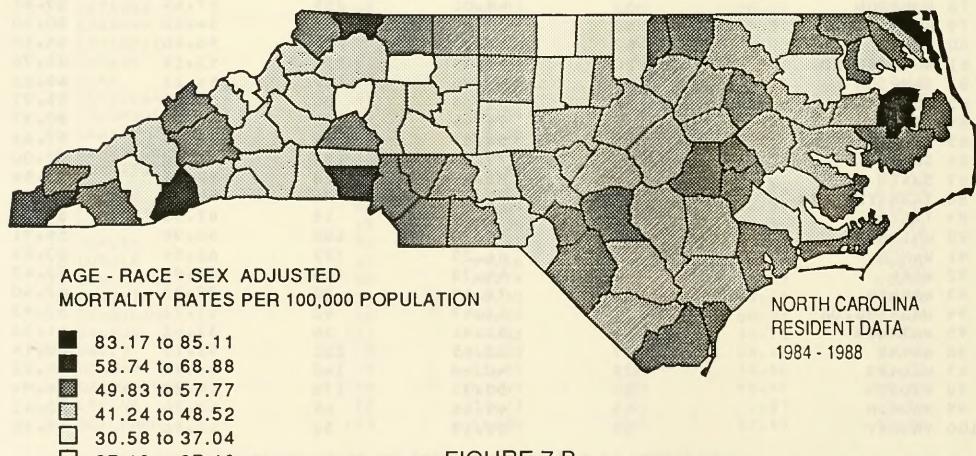
FIGURE 7.B

CANCER OF THE FEMALE BREAST

Breast cancer is the second leading cause of cancer death in American women (2). It is estimated that there will be 142,900 new breast cancer cases and more than 453,300 deaths in the United States in 1989 (20). According to the American Cancer Society, one in 10 American women will develop the disease in her lifetime (2).

Several risk factors for breast cancer have been consistently identified. They include: older age, upper socioeconomic class, never having been married, urban residence, residence in the Northern U.S., white race, late age at first full-term pregnancy, early menarche, late menopause, family history of a primary cancer of the ovary or endometrium. Artificial menopause has been shown to exert a protective effect. Additional research into breast cancer etiology is needed as only 25 percent of the current breast cancer burden can be explained by known risk factors. Current areas of research include alcohol consumption, oral contraceptive use, mammographic parenchymal patterns, hormone replacement therapy, and high-fat diet. (21)

Between 1975 and 1985, there was a 17 percent increase in the incidence of breast cancer in the National Cancer Institute's population-based Surveillance, Epidemiology and End Results (SEER) program (4). The 1985 age-adjusted incidence rate for white women was 19 percent higher than that for black women. Mortality rates over the same period remained essentially stable for white women while increasing at an average annual rate of less than one percent for black women (14).

Survival rates for breast cancer in the SEER areas improved slightly between 1975 and 1985. Overall five-year relative survival rates for all stages of breast cancer for the period 1979-84 were 75 percent and 62 percent for white and black women, respectively. (14) For localized breast cancer, there was a less radical difference in survival. For white women, the five-year survival rate was 90 percent and for black women, 87 percent (21). An improved survival rate has stabilized the mortality rate, despite the increased incidence (2).

In 1988, a total of 1,093 North Carolina women died of breast cancer, still the leading cause of cancer deaths in N.C. females. This accounted for 8.6 percent of the state's cancer deaths. The 1988 mortality rate was 32.5 deaths per 100,000 female population which represents a 6.1 percent increase over 1987. However, there was virtually no change in the age-adjusted death rate.

The five-year (1984-88) age-adjusted rate was 11.2 percent higher than in 1979-83. The rate for whites increased 8.4 percent while that for nonwhites rose 23.3 percent. In 1986, North Carolina had the 25th highest age-adjusted mortality in the nation (22). This rate was 2.4 percent less than that for the U.S.

In North Carolina, breast cancer deaths rarely occur prior to age 35 in both white and nonwhite women, and the number peaks at ages 55-64 for both race groups. For both races, the death rate is highest at ages 85 and older (3).

GEOGRAPHIC PATTERNS

During the period 1984-88, no statistically significant clusters of high rates were observed, although moderate rates did occur in some contiguous counties (Figures 8.A and 8.B). Users

should consult these maps to ascertain a county's relative level
of unadjusted and age-race-sex-adjusted mortality from female
breast cancer.

M O R T A L I T Y   S T A T I S T I C S   F O R   1 9 8 8

N O R T H   C A R O L I N A   R E S I D E N T S

C A N C E R   -   B R E A S T   -   F E M A L E

GEOGRAPHICAL AREA	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
NORTH CAROLINA	1093	32.48	5107	31.18	31.16
REGIONS					
DHR I WESTERN	407	35.17	1833	32.54	30.93
DHR II N. CENTRAL	233	32.58	1132	32.40	30.99
DHR III S. CENTRAL	237	29.99	1087	28.46	31.93
DHR IV EASTERN	216	30.77	1055	30.72	30.53
HSA I WESTERN	189	33.23	910	32.55	28.82
HSA II PIEDMONT	203	32.17	1004	32.54	31.63
HSA III S. PIEDMONT	218	37.03	923	32.52	32.59
HSA IV CAPITAL	150	29.72	699	29.04	31.19
HSA V CARDINAL	145	29.04	707	28.92	31.57
HSA VI EASTERN	188	32.84	864	30.74	30.45
COUNTIES					
1 ALAMANCE	12	21.34	83	30.30	26.75
2 ALEXANDER	1	7.19	15	22.09	23.85
3 ALLEGHANY	2	39.36	8	31.62	20.72
4 ANSON	3	21.23	26	36.94	35.03
5 ASHE	5	41.26	20	33.24	23.46
6 AVERY	3	38.89	10	26.28	20.79
7 BEAUFORT	8	35.69	35	31.35	28.51
8 BERTIE	2	17.79	21	37.16	32.57
9 BLADEN	4	24.78	18	22.44	20.76
10 BRUNSWICK	7	26.78	33	27.16	27.26
11 BUNCOMBE	30	32.78	156	34.80	28.87
12 BURKE	15	37.70	62	31.72	33.83
13 CABARRUS	26	51.89	106	43.47	39.33
14 CALDWELL	13	35.51	48	26.66	28.32
15 CAMDEN	2	64.43	8	52.76	45.77
16 CARTERET	8	31.10	41	33.05	34.19
17 CASWELL	3	26.48	12	21.19	21.95
18 CATAWBA	16	26.30	93	31.46	31.30
19 CHATHAM	5	26.50	23	25.03	23.57
20 CHEROKEE	5	45.19	16	29.88	20.81
21 CHOWAN	3	40.37	19	52.76	46.83
22 CLAY	1	27.27	9	49.93	32.95
23 CLEVELAND	18	39.43	79	35.12	32.66
24 COLUMBUS	6	21.70	38	27.70	28.25
25 CRAVEN	14	34.84	54	27.55	32.21
26 CUMBERLAND	32	25.86	134	21.76	31.70
27 CURRITUCK	5	73.01	10	30.52	29.98
28 DARE	2	18.51	14	29.70	24.98
29 DAVIDSON	26	40.48	102	32.61	35.23
30 DAVIE	10	70.64	30	43.79	51.92
31 DUPLIN	4	18.25	31	28.40	25.42
32 DURHAM	37	40.15	157	35.39	36.41
33 EDGECOMBE	17	52.32	53	33.30	32.00
34 FORSYTH	47	33.20	227	32.78	31.61
35 FRANKLIN	6	32.25	21	23.72	21.03
36 GASTON	25	27.31	114	25.29	24.96
37 GATES	2	40.46	9	37.51	26.73
38 GRAHAM	1	28.26	2	11.10	8.20
39 GRANVILLE	5	25.43	17	17.96	14.54
40 GREENE	3	35.57	9	21.22	21.25
41 GUILFORD	53	29.66	288	32.91	32.45

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

COUNTIES (CONT'D)	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
42 HALIFAX	8	26.81	44	29.84	23.34
43 HARNETT	18	52.82	55	33.43	35.74
44 HAYWOOD	9	35.91	46	36.91	45.92
45 HENDERSON	21	57.94	81	46.29	37.58
46 HERTFORD	4	32.11	22	35.16	26.59
47 HOKE	2	16.08	11	18.42	24.96
48 HYDE	0	0.00	4	26.63	21.87
49 IREDELL	20	42.06	86	37.34	35.03
50 JACKSON	3	21.36	21	30.20	28.25
51 JOHNSTON	11	26.16	53	26.10	24.31
52 JONES	2	37.41	10	37.59	25.59
53 LEE	7	31.70	35	32.61	32.69
54 LENOIR	7	21.78	50	31.12	28.90
55 LINCOLN	8	32.15	30	25.26	29.60
56 MCDOWELL	4	21.31	14	14.94	14.10
57 MACON	8	65.67	23	38.35	22.61
58 MADISON	3	34.29	14	31.93	23.45
59 MARTIN	5	35.51	21	29.82	29.87
60 MECKLENBURG	93	37.30	391	32.93	35.85
61 MITCHELL	0	0.00	10	26.77	18.54
62 MONTGOMERY	4	32.38	26	42.51	39.02
63 MOORE	19	61.60	71	48.47	39.96
64 NASH	15	38.99	62	32.88	31.24
65 NEW HANOVER	15	24.29	95	31.66	32.52
66 NORTHAMPTON	6	53.05	29	50.69	43.01
67 ONSLOW	8	15.31	46	17.95	27.81
68 ORANGE	8	17.24	49	22.12	30.22
69 PAMLICO	1	17.39	4	14.00	13.70
70 PASQUOTANK	4	24.86	21	26.77	25.51
71 PENDER	0	0.00	25	38.35	35.56
72 PERQUIMANS	2	34.22	9	32.47	26.85
73 PERSON	8	48.62	25	31.22	27.62
74 PITT	17	31.30	78	29.89	34.78
75 POLK	1	12.89	13	33.95	20.40
76 RANDOLPH	16	30.14	80	31.28	34.51
77 RICHMOND	10	41.62	40	33.46	30.18
78 ROBESON	13	22.69	58	20.59	26.08
79 ROCKINGHAM	12	26.54	79	35.31	33.10
80 ROWAN	24	43.35	91	33.67	29.55
81 RUTHERFORD	6	19.74	55	36.69	27.61
82 SAMPSON	6	22.55	43	32.60	30.98
83 SCOTLAND	6	32.88	34	38.06	42.84
84 STANLY	9	33.79	46	35.09	33.59
85 STOKES	4	21.37	24	26.20	23.62
86 SURRY	14	43.33	51	32.00	29.45
87 SWAIN	1	18.02	6	21.48	19.57
88 TRANSYLVANIA	10	74.41	31	47.23	41.66
89 TYRRELL	2	91.61	6	54.87	48.91
90 UNION	13	30.08	59	28.69	32.27
91 VANCE	5	24.17	46	45.23	42.58
92 WAKE	52	26.15	254	27.28	33.00
93 WARREN	6	68.27	19	43.78	35.16
94 WASHINGTON	3	39.23	12	31.67	25.36
95 WATAUGA	9	50.70	37	42.13	40.26
96 WAYNE	23	44.82	83	32.59	33.89
97 WILKES	3	9.53	26	16.68	13.87
98 WILSON	11	31.38	59	34.13	33.54
99 YADKIN	6	38.82	28	36.99	27.36
100 YANCEY	1	12.11	15	36.96	61.84

* SEE SECTION II

CANCER - FEMALE BREAST

MORTALITY RATES PER 100,000 FEMALE POP.

- ■ 48.47 to 54.87
- ▨ 42.13 to 47.24
- ▨ 28.40 to 38.36
- ▨ 20.59 to 27.70
- □ 14.00 to 18.42
- □ 11.11 to 11.11

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
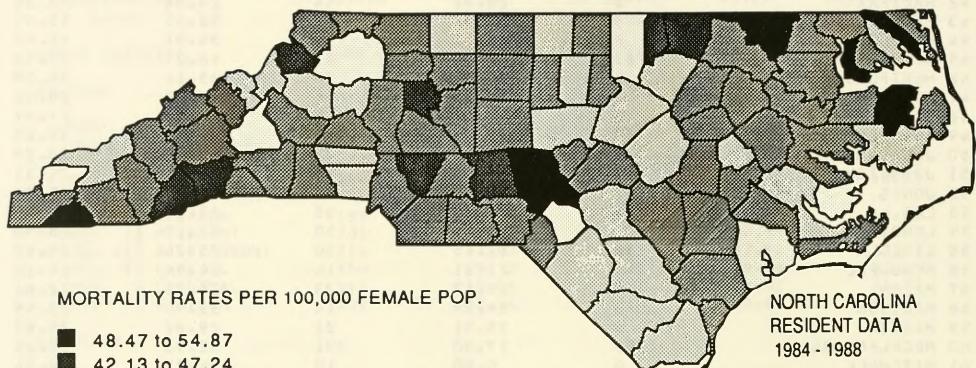
FIGURE 8.A

CANCER - FEMALE BREAST

AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 FEMALE POP.

- ■ 61.84 to 61.84
- ▨ 45.78 to 51.92
- ▨ 37.59 to 43.01
- ▨ 26.08 to 36.42
- □ 18.55 to 25.60
- □ 8.21 to 14.55

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
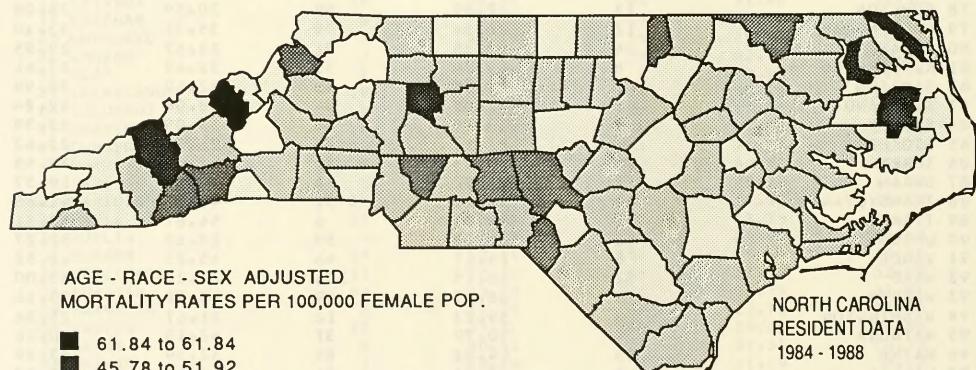
FIGURE 8.B

CANCER OF THE PROSTATE

Prostate cancer is a major cause of morbidity and mortality among males in the United States, with almost one out of 11 men developing the disease during his lifetime. In North Carolina during 1989 alone, an estimated 2,700 new cases will be diagnosed. (2) The death rate for this disease changes dramatically with age, increasing over one-hundred fold between ages 50 and 80. It is also much higher in blacks than whites. In fact, blacks in certain regions of North Carolina have some of the highest prostate cancer mortality rates in the world. The high rate among blacks may be related to genetic or environmental factors as well as to health care access or quality issues. (23)

Despite the importance of this disease, little is known about its cause. Studies examining hormonal, social, and sexual factors have yielded uniformly unimpressive results. Certain occupations, such as farming, have been associated with an increased risk of developing prostate cancer as has exposure to cadmium. The roles of dietary factors, sunlight, and farming are currently under study. (24)

No screening methods have been proven effective for prostate cancer. Currently several methods, including tests for acid phosphates, prostate-specific antigen, and prostatic ultrasound, are under investigation. Treatment for prostate cancer relies upon surgical removal of early-stage disease. Once the disease has spread, hormonal therapy has only a palliative role although recent studies of new hormonal analogues are promising. (25)

5-31

In 1988, a total of 839 North Carolina men died of prostate cancer. This accounted for 6.6 percent of the state's cancer deaths and 1.5 percent of all deaths. The mortality rate in 1988 was 26.9 deaths per 100,000 male population which represents a six percent increase over the 1987 mortality rate. The 1988 age-adjusted rate was four percent above the 1987 level.

The five-year age-adjusted mortality rate (1984-88) was essentially unchanged from that of the preceding five-year period (1979-83). However, there was a 10 percent increase among nonwhites.

The nonwhite age-adjusted rate for prostate cancer in 1984-88 approached three times the white rate. Therefore, a wide race differential exists in North Carolina as elsewhere.

In North Carolina, prostate cancer deaths among persons under age 55 are relatively rare. For ages 65-74, the rate is 131.4 deaths per 100,000 male population. The rate nearly triples for ages 75-84, and peaks at 610.7 at ages 85 and older. (3)

GEOGRAPHIC PATTERNS

Following the procedures described in Section II, a few significant clusters of high-rate counties are identified when the 1984-88 unadjusted death rates are mapped, as shown on the following page. The clustering of high-rate counties in the northeast is striking. However, with race and age adjustment, no significant clusters are found. These results are apparent in Figures 9.A and 9.B which show unadjusted and adjusted rate levels respectively for each county. All counties are encouraged to consult these figures to determine their relative levels of unadjusted and age-race-adjusted mortality from prostate cancer.

CANCER - PROSTATE

MORTALITY RATES PER 100,000 MALE POP.

■ 35.59 to 87.89 (p<=.01)
□ 9.38 to 35.13

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
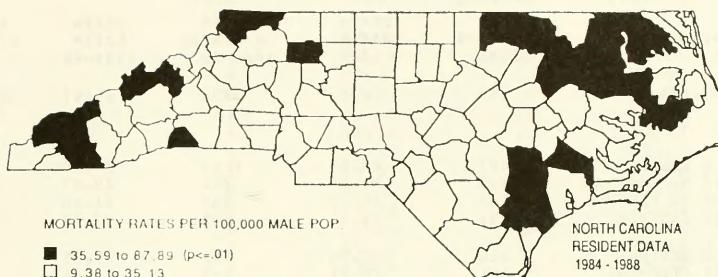
MORTALITY STATISTICS FOR 1988

NORTH CAROLINA RESIDENTS

CANCER - PROSTATE

GEOGRAPHICAL AREA	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
NORTH CAROLINA	839	26.86	3736	24.47	24.47
REGIONS					
DHR I WESTERN	297	27.85	1254	24.09	24.09
DHR II N. CENTRAL	203	31.31	822	25.87	24.78
DHR III S. CENTRAL	147	19.79	765	21.20	23.73
DHR IV EASTERN	192	28.83	895	27.33	24.97
HSA I WESTERN	160	30.36	661	25.45	23.59
HSA II PIEDMONT	161	28.21	689	24.61	24.83
HSA III S. PIEDMONT	137	25.40	593	22.74	24.54
HSA IV CAPITAL	123	26.45	509	22.88	23.76
HSA V CAROINAL	103	21.74	557	23.86	24.78
HSA VI EASTERN	155	28.32	727	26.91	24.39
COUNTIES					
1 ALAMANCE	20	40.25	68	27.90	25.56
2 ALEXANDER	2	14.63	12	17.99	23.03
3 ALLEGHANY	3	63.31	10	42.44	23.41
4 ANSON	0	0.00	16	26.33	19.76
5 ASHE	5	43.97	26	45.96	25.55
6 AVERY	2	26.52	7	18.75	13.97
7 BEAUFORT	5	24.97	33	33.00	23.16
8 BERTIE	2	20.41	18	36.36	22.58
9 BLADEN	5	33.79	23	31.11	24.37
10 BRUNSWICK	9	36.25	31	26.72	24.70
11 BUNCOMBE	34	41.61	112	27.93	23.49
12 BURKE	8	21.31	31	16.77	16.66
13 CABARRUS	4	8.72	25	11.18	10.92
14 CALDWELL	3	8.60	38	22.15	30.06
15 CAMDEN	0	0.00	2	13.91	10.63
16 CARTERET	9	35.54	34	27.80	30.13
17 CASWELL	3	27.60	15	27.47	23.91
18 CATAWBA	10	17.69	41	14.90	18.55
19 CHATHAM	5	27.97	28	31.98	25.04
20 CHEROKEE	3	29.63	9	18.32	9.75
21 CHOWAN	11	175.57	27	87.89	48.10
22 CLAY	0	0.00	3	16.91	8.31
23 CLEVELAND	14	33.75	55	26.78	25.52
24 COLUMBUS	9	36.12	42	33.75	28.97
25 CRAVEN	4	9.65	21	10.32	12.56
26 CUMBERLAND	12	9.16	80	12.14	25.18
27 CURRITUCK	2	28.01	12	35.07	35.58
28 DARE	3	28.15	12	25.79	17.74
29 DAVIDSON	4	6.65	39	13.27	17.46
30 DAVIE	7	51.13	16	24.14	27.12
31 DUPLIN	6	30.38	40	40.43	30.93
32 DURHAM	26	32.77	101	26.33	23.25
33 EDGECOMBE	15	54.75	58	42.82	37.79
34 FORSYTH	34	27.24	171	27.92	27.23
35 FRANKLIN	5	29.68	23	28.52	18.55
36 GASTON	20	24.19	87	21.28	25.87
37 GATES	3	61.88	10	42.27	20.70
38 GRAHAM	7	201.20	9	50.95	26.38
39 GRANVILLE	5	25.88	20	21.48	12.86
40 GREENE	2	25.14	5	12.49	6.90
41 GUILFORD	47	29.71	201	25.88	25.80

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

COUNTIES (CONT'D)	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
42 HALIFAX	10	37.03	48	35.81	22.51
43 HARNETT	11	34.14	50	32.05	35.35
44 HAYWOOD	4	17.23	26	22.46	24.35
45 HENDERSON	14	42.40	56	35.05	34.68
46 HERTFORD	7	62.41	28	49.39	25.89
47 HOKE	4	34.66	10	17.87	20.93
48 HYDE	1	36.17	6	42.17	33.47
49 IREDELL	13	29.51	56	26.22	23.90
50 JACKSON	6	46.12	15	23.10	18.85
51 JOHNSTON	10	25.88	53	28.33	28.51
52 JONES	0	0.00	10	44.04	23.35
53 LEE	3	15.10	19	19.58	20.09
54 LENOIR	5	17.75	33	23.32	18.77
55 LINCOLN	4	16.86	18	15.88	14.12
56 MCDOWELL	4	22.76	17	19.37	22.49
57 MACON	8	71.28	35	62.97	57.77 *
58 MADISON	5	58.93	19	44.82	69.56 *
59 MARTIN	7	56.73	23	37.01	24.76
60 MECKLENBURG	60	26.46	240	22.17	26.85
61 MITCHELL	2	27.97	8	22.63	11.83
62 MONTGOMERY	2	16.92	11	18.77	16.04
63 MOORE	3	10.53	41	30.26	19.66
64 NASH	7	20.42	45	26.67	25.66
65 NEW HANOVER	14	25.14	67	24.74	26.71
66 NORTHAMPTON	0	0.00	13	23.70	13.43
67 ONSLOW	2	2.73	34	9.37	29.44
68 ORANGE	6	14.25	37	18.39	22.15
69 PAMLICO	2	38.22	7	26.90	18.26
70 PASQUOTANK	10	68.54	28	39.13	28.92
71 PENDER	5	38.06	28	45.36	28.31
72 PERQUIMANS	5	96.33	9	36.29	16.85
73 PERSON	8	53.43	23	31.38	26.49
74 PITT	8	16.77	55	23.91	23.22
75 POLK	3	43.07	17	49.37	26.03
76 RANDOLPH	14	28.17	50	20.80	23.85
77 RICHMOND	6	27.47	34	31.23	25.31
78 ROBESON	8	15.76	64	25.46	18.76
79 ROCKINGHAM	12	29.06	56	27.37	25.13
80 ROWAN	14	27.36	88	35.13	27.35
81 RUTHERFORD	14	51.04	37	27.24	22.23
82 SAMPSON	7	28.82	34	28.16	21.46
83 SCOTLAND	8	48.60	26	32.20	34.14
84 STANLY	10	40.95	35	29.00	26.43
85 STOKES	4	22.50	15	17.21	19.65
86 SURRY	7	23.48	29	19.68	18.06
87 SWAIN	2	40.24	9	35.59	23.20
88 TRANSYLVANIA	1	7.84	17	27.11	16.48
89 TYRRELL	0	0.00	3	31.17	17.69
90 UNION	12	29.41	44	22.60	26.85
91 VANCE	17	91.45	44	47.96	32.65
92 WAKE	31	16.34	138	15.50	22.75
93 WARREN	7	89.31	23	58.91	25.67
94 WASHINGTON	2	28.60	15	43.00	34.63
95 WATAUGA	0	0.00	10	11.93	9.59
96 WAYNE	19	40.15	64	27.04	27.43
97 WILKES	5	16.68	26	17.47	24.94
98 WILSON	8	26.19	34	22.44	17.38
99 YADKIN	9	60.53	29	39.81	41.56
100 YANCEY	1	12.89	16	41.78	22.81

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

CANCER - PROSTATE

MORTALITY RATES PER 100,000 MALE POP.

- ■ 87.89 to 87.89
- ■ 58.91 to 62.97
- ▨ 39.13 to 50.95
- ▨ 30.26 to 37.01
- □ 20.81 to 29.01
- □ 9.38 to 19.69

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
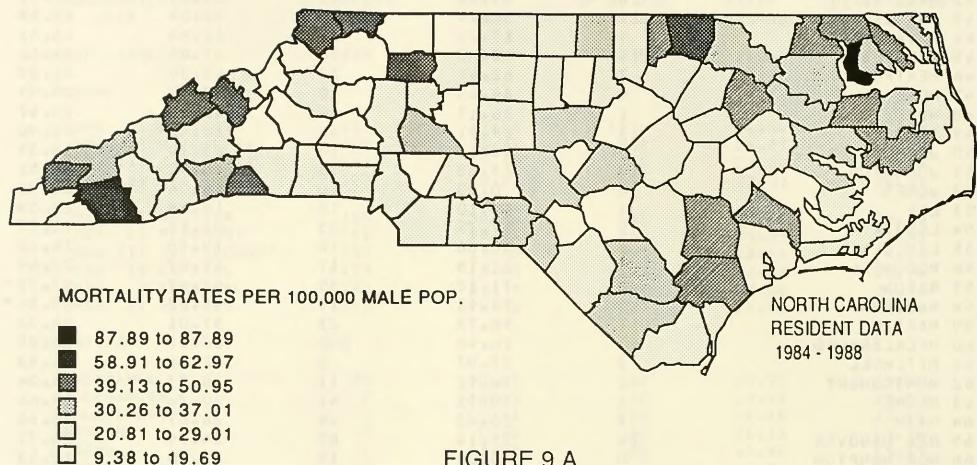
FIGURE 9.A

CANCER - PROSTATE

AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 MALE POP.

- ■ 69.56 to 69.56
- ■ 57.78 to 57.78
- ▨ 41.56 to 48.11
- ▨ 32.65 to 37.79
- □ 16.05 to 30.93
- □ 6.91 to 14.13

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
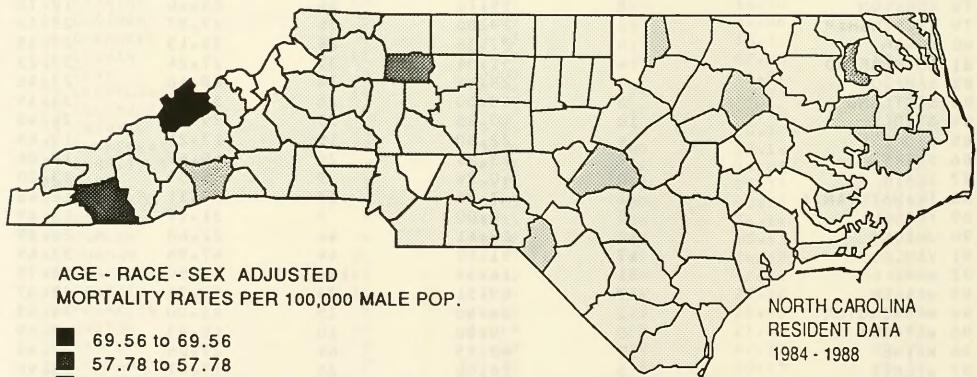
FIGURE 9.B

CANCER IN SPECIAL POPULATIONS

BLACK AMERICANS AND CANCER

Cancer is the second leading cause of death among adult Americans, including minority adults. Black Americans constitute the largest minority population in the U.S. (12%) and in North Carolina (22%) and experience the highest overall age-adjusted cancer mortality and incidence rates of any U.S. population group (26).

In North Carolina in 1988, cancer was the second leading cause of death for nonwhite males and females with 226.6 deaths and 139.5 deaths per 100,000 population respectively. In the same year, the years of life lost per 100,000 population ranked cancer second for nonwhite females and third for nonwhite males.

For 1978-81, the major contributors to cancer deaths among U.S. blacks, in terms of mortality rates per 100,000 population, were cancer of the lung (males: 91.4, females: 26.3), pancreas (11.0), esophagus (9.2), cervix uteri (females: 8.8) (27). Over the last 30 years, cancer mortality rates in U.S. blacks increased almost 50 percent while the white rates rose only 10 percent, with blacks suffering a significantly greater rise in the incidence rates for cancer of the lung, colon and rectum, prostate, and esophagus (2).

In North Carolina the greatest percent increases in age-adjusted (1970 standard) mortality rates among blacks between the

five-year periods 1979-83 and 1984-88 were seen in the following sites: lung (males: 16.4, females 24.4), female breast (21.3), cervix (20.2), pancreas (males: 11.6, females: 5.5), prostate (8.4), colorectal (males: 7.4, females: 10.4) and stomach (males: 6.0, females: 13.2).

In 1988 the five leading contributors to cancer mortality among nonwhite males in N.C. were: lung, prostate, colorectal, pancreas, and esophagus. The picture for nonwhite females is somewhat different. For them, the five leading contributors to cancer deaths were: breast, colorectal, lung, pancreas and cervix.

The difference in the U.S. cancer five-year survival rate for blacks (37%) and whites (50%) has remained stable over the last 20 years (21). Blacks have significantly lower survival rates for cancer of the bladder (47% vs. 73%), corpus uteri (56% vs. 87%), breast (61% vs. 73%), and colon (44% vs. 49%) (28).

Overall cancer mortality is approximately 30 percent higher for U.S. blacks compared to whites (29). Several factors may explain this excess in cancer mortality among blacks:

Social and Dietary Habits - The proportion of smokers among U.S. blacks was 45 percent compared to 37 percent among whites. Blacks eat more nitrate and animal foods and less fiber in relation to protein, fat, and carbohydrate when compared to whites. Blacks also have poorer nutritional status. (30, 31)

Socioeconomic Status - The poorer survival of U.S. blacks with breast cancer is equalized when the socioeconomic status of the patients is taken into account (32). A larger study of incidence rates found that poverty accounted for almost all of the differences between blacks and whites for

cancer of the cervix, esophagus, male lung, pancreas, and stomach. Poverty did not explain differences in the incidence of cancer of the prostate. (33)

Treatment Factors - Black women with breast cancer receive less aggressive therapy than white patients. Blacks are more likely to be treated nonsurgically or to receive no cancer treatment compared to white women with breast cancer. The differences in treatment persisted after taking into account the age of the patient and the clinical stage and histology of the tumor. Survival was strongly influenced by the type of treatment, with patients receiving no treatment having half the survival of patients who were treated surgically. (34)

Health Attitudes and Knowledge - Blacks may be less educated about cancer than whites, and may be less likely to utilize screening and prevention strategies. A 1980 American Cancer Society (ACS) study revealed that blacks believe that cancer is the main concern of whites, while hypertension and sickle cell anemia are the primary concerns of blacks (26). A 1986 survey by the ACS showed that, while 92 percent of white women knew of the Pap test for prevention/detection of cervical cancer, only 76 percent of black women knew of the test (2). Preliminary data analysis of a survey of over 1,200 women in rural North Carolina found significantly lower use of mammography by black women even after controlling for socioeconomic factors (35). Finally, one study found that blacks as compared to whites are: inclined to underestimate cancer prevalence and have less knowledge of warning signs; more likely to hold a fatalistic attitude about cancer, being less inclined to view early detection and existing treatments as making an effective difference; less likely to seek medical treatment when symptoms are present; and less aware of the risks associated with various types of cancer (36).

Smoking Cessation and Prevention – Smoking cessation and prevention has been identified by the National Cancer Institute as the key priority in reducing cancer mortality among blacks who have the highest male lung cancer incidence and mortality rates. Esophageal, laryngeal, and bladder cancer are also related to cigarette smoking. (37)

Breast Cancer Screening – Breast cancer is the most common malingnancy among both black and white women and is essentially tied with lung cancer as the leading cause of cancer mortality among women (38, 39). Mammography can reduce breast cancer mortality by as much as a third in women over 50. In the absence of screening, breast cancer is diagnosed at a later stage in black women, with resulting lower survival and higher mortality rates. Understanding and narrowing this differential is a key opportunity for reducing breast cancer mortality in black women.

Dietary Modification – Though further etiologic research is essential, interim dietary recommendations have been made, with reasonable evidence to support them. For example, reducing the intake of dietary fat and increasing the intake of fiber has been recommended by official bodies as possibly beneficial for reducing cancer risk. (40)

Cervical Cancer Screening – The black cervical cancer mortality rate is 2.75 times the white rate despite the broad availability of an inexpensive and effective screening test (40). A recent U.S. health survey indicated that only 70 percent of black women had at least one Pap smear, compared to 85 percent of white women (2).

Etiologic Research - Existing knowledge and technology are severely limited with respect to several of the important cancers responsible for black-white mortality differences, including prostate cancer for which black men have almost a two-fold greater mortality rate than do white men. Although this difference is partly due to lower survival rates, identification of modifiable risk factors for the occurrence and progression of this cancer is crucial to advances in its control (42).

Priority in cancer control among blacks should be given to measures that will affect the cancer sites for which there is an excess black mortality rate, a deficit in the survival rate, or a large absolute number of black cancer deaths.

A recent study of the survival of cancer patients demonstrates that survival rates for Hispanics are approximately the same as for whites (28). Hispanics compared to whites had small deficits in survival for cancer of the bladder (64% vs. 73%) and Hodgkins disease (61% vs. 70%), and a small excess in survival for cancer of the ovary (42% vs. 35%). These figures did not include residents of Puerto Rico, where preliminary data indicate that the population is more similar to blacks than to non-Hispanic whites.

In the same study, the numbers of other ethnic groups were too small for direct comparisons. The trends, however, were for the survival rates of Hawaiians and Chinese to be comparable to those of white patients, while the rates for American Indians and Filipinos tended to be lower than rates for whites.

CANCER AND THE POOR

In 1989 an American Cancer Society study of cancer among this nation's poor found that the poor: (1) Die sooner and

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suffer more because their disease is diagnosed at later stages when the treatment options are more limited. Poor individuals have a survival rate 10-15 percent below that of other Americans. (2) Face substantial barriers to obtaining health insurance and often do not seek care that they cannot afford. The poor are often forced to accept substandard treatment. An estimated 37 million persons are uninsured, and others have inadequate health insurance. (3) The poor must make extraordinary personal sacrifices to obtain and pay for health care. (4) Cancer education and outreach efforts are insensitive and irrelevant to many poor people. (5) Fatalism about cancer prevails among the poor and prevents them from gaining quality health care. (41)

The American Cancer Society currently estimates that about 90,000 poor Americans annually will die unnecessarily of cancer because of inability to obtain earlier diagnosis and treatment (41).

CANCER IN CHILDREN

Although cancer is a rare disease among children, it is the leading cause of death by disease in children between the ages of 3 and 14 (2). Childhood cancer incidence rates have remained stable over the last decade. Ninety percent of incident cancers are comprised of leukemias and lymphomas, malignant tumors of the central and sympathetic nervous systems, and tumors of the soft tissues, kidney, bone, and liver as well as retinoblastomas of the eye. White children, in a study reported by Young, et. al. (42), had higher rates of leukemias and lymphomas (44% vs. 33%) while blacks had slightly higher rates of nervous system tumors (29% vs. 24%).

In the same study, five-year survival rates for all tumors were 57 percent for both whites and blacks. The five-year survival rate for fibrosarcomas, retinoblastomas, Hodgkins

disease and gonadal and germ cell tumors exceeded 80 percent. Comparing 1967-73 survival rates with 1973-81 rates, all cancer sites have increased in survival. Leukemias have the greatest improvement, from 15 percent to 51 percent. (42)

REFERENCES FOR SECTION V

1. Bailar, JC III, Smith, EM. "Progress Against Cancer?," New England Journal of Medicine. 314, 1986, pp. 1226-32.

2. American Cancer Society. Cancer Facts and Figures-1988. New York, 1988.

3. State Center for Health Statistics. "Health of the Elderly in N.C.: Population at Risk and Patterns and Trends in Mortality," SCHS Studies, November 1981.

4. National Center for Health Statistics. "Advance Report of Final Mortality Statistics, 1987," Monthly Vital Statistics Report. Volume 38, Number 5 supp., Hyattsville, Maryland: Public Health Service, September 26, 1989.

5. North Carolina Department of Human Resources, State Center for Health Statistics. Leading Causes of Mortality: North Carolina Vital Statistics, Volume 2, 1981. Raleigh, September 1983.

6. Greenwald P, Lanza E, Eddy GA. "Dietary Fiber in the Reduction of Colon Cancer Risk," Journal of American Dietetic Association. 87, 1987, pp. 1178-88.

7. Kolonel LN, Marchand LL. "The Epidemiology of Colon Cancer and Dietary Fat," Dietary Fat and Cancer. New York, 1986, pp. 69-91.

8. Wargovich MJ. "New Dietary Anticarcinogens and Prevention of Gastrointestinal Cancer," <u>Dis Colon Rectum</u>. 31, 1988, pp. 72-75.

9. Sorenson AW, Slattery ML, Ford MH. "Calcium and Colon Cancer: A Review," <u>Nutr Cancer</u>. 11, 1988, pp. 135-45.

10. Slattery ML, Schumacher C, Smith KR, West DW, Abd-elghany N. "Physical Activity, Diet, and Risk of Colon Cancer in Utah," <u>Am J Epidemiol</u>. 1988, pp. 9898-99.

11. Fearon ER, Hamilton SR, Vogelstein B. "Clonal Analysis of Human Colorectal Tumors," <u>Science</u>. 238, 1987, pp. 193-7.

12. Centers for Disease Control. "Chronic Disease Reports: Deaths from Colorectal Cancer - United States, 1986," <u>Morbidity and Mortality Weekly Report</u>. Volume 38, Number 42, U.S. Government Printing Office, Washington, 1989, p. 726.

13. U.S. Department of Health and Human Services. <u>Reducing the Health Consequences of Smoking: 25 Years of Progress. A Report of the Surgeon General</u>. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. DHHS Publication No. (CDC) 89-8411, 1989.

14. National Cancer Institute. <u>1987 Annual Cancer Statistics Review, Including Cancer Trends 1950 -1985</u>. Bethesda, MD, 1988.

15. Centers for Disease Control. "Chronic Disease Reports: Deaths from Lung Cancer - United States, 1986," <u>Morbidity and Mortality Weekly Report</u>. Volume 38, Number 29, U.S. Government Printing Office, Washington 1989, p. 502.

16. Fink DJ, McKenna RJ. "Introduction - Workshop on the Community and Cancer Prevention and Detection," _Cancer_. 61, 1988, p. 2363.

17. Saracci R. "The Interactions of Tobacco Smoking and Other Agents in Cancer Etiology," _Epidemiologic Reviews_. 9, 1987, p. 175.

18. Doll R, Peto R. "The Causes of Cancer: Quantitative Estimates of Avoidable Risks of Cancer in the United States Today." _Journal of National Cancer Institute_. 66, 1981, p. 1191.

19. Colditz GA, Stampfer MJ, Willett WC. "Diet and Lung Cancer. A Review of the Epidemiologic Evidence in Humans," _Arch Int Med_. 147, 1987, p. 157.

20. Silverberg, E. and Luberg, JA. "Cancer Statistics, 1989," _Ca- A Cancer Journal for Clinicians_. 39, 1989, pp. 3-20.

21. Kelsey, JL and Berkowitz, GS. "Breast Cancer Epidemiology," _Cancer Research_. 45, 1988, pp. 5615-5623.

22. Centers for Disease Control. "Chronic Disease Reports: Deaths from Breast Cancer Among Women - United States, 1986," _Morbidity and Mortality Weekly Report_. Volume 38, Number 33, U.S. Government Printing Office, Washington 1989, p. 566.

23. Riggan WB, Creason JP, Nelson WC, et al. _U.S. Cancer Mortality Rates and Trends, 1950-1979_. United States Environmental Protection Agency, Research Triangle Park, NC, 1987.

24. Greenwald P. "Prostate," in <u>Cancer Epidemiology and Preven-</u><u>tion</u>. Schottenfeld D, Fraumeni JF, eds. Philadelphia, 1982, pp. 939-946.

25. Lee F, Torp-Pedersen ST, Siders DB. "Screening Techniques, Including Transrectal Ultrasound," <u>CA-A Cancer Journal for</u> <u>Clinicians</u>. 39(6), 1989, pages are pending publication.

26. Bang, K.M., White, J.E., Gause, B.L. and Leffall Jr., L.D. "Evaluation of Recent Trends in Cancer Mortality and Inci-dence Among Blacks," <u>Cancer</u>. 61, 1988, pp. 1255-61.

27. U.S. Department of Health and Human Services. <u>Cancer Among</u> <u>Blacks and Other Minorities: Statistical Profiles</u>. Washing-ton, D.C. 1986.

28. Young, J.L., Ries, L.G. and Posseck, E.S. "Cancer Patient Survival Among Ethnic Groups in the United States," <u>J Natl</u> <u>Cancer Inst</u>. 73, 1984, pp. 341-52.

29. Control, C.F.D. "Premature Mortality Due to Malignant Neoplasms - United States," <u>Morbidity and Mortality Weekly</u> <u>Report</u>. 35, 1986, pp. 459-61.

30. Hargreaves, M.K., Bequet, C. and Gamshadehi, A. "Diet, Nutritional Status, and Cancer Risk in American Blacks," <u>Nutr. Cancer</u>. 12, 1989, pp. 1-28.

31. Hill, M.J. "Dietary Fat and Human Cancer (Review)," <u>Anticancer Res</u>. 7 (3), 1987, pp. 281-92.

32. Bassett, M.T. and Krieger, N. "Social Class and Black-White Differences in Breast Cancer Survival," <u>Am J Public Health</u>. 75, 1986, pp. 1400-03.

33. McWhorter, W.P., Schatzkin, A.G., Horm, J.W. and Brown, C.C. "Contribution of Socioeconomic Status to Black/White Differences in Cancer Incidence," Cancer. 63, 1989, pp. 982-7.

34. McWhorter, W.P. and Mayer, W.J. "Black/White Differences in Type of Initial Breast Cancer Treatment and Implications for Survival," Am J Public Health. 77, 1987, pp. 1515-17.

35. Harris, R. and Fletcher, S. 1988 Breast Cancer Screening in Rural North Carolina. Abstract accepted for presentation at the Annual Meeting of the American Public Health Association, Boston, MA, November 13-17, 1988.

36. US Department of Health and Human Services. Report of the Secretary's Task Force on Black and White Minority Health. Washington, D.C., 1986.

37. Baquet, C. and Ringen, K. "Cancer Control in Blacks: Epidemiology and NCI Program Plans," Prog Clin Biol Res. 216, 1986, pp. 215-227.

38. Moskowitz, M. "Mammography to Screen Asymptomatic Women for Breast Cancer," Amer J Radiol. 143, 1984, pp. 457-9.

39. Stanford, F.L. "Breast Cancer Incidence in Young Women by Estrogen Receptor Status and Race," Am J Public Health. 79, 1989, pp. 71-73.

40. National Cancer Institute. Cancer Control: Objectives for the Nation 1985-2000. Bethesda, MD., 1985.

41. American Cancer Society. Cancer and the Poor: A Report to the Nation. Atlanta, 1989.

42. Young, J.L., Ries, L.G., Silverberg, E., Horm, J.W. and Miller, R.W. "Cancer Incidence, Survival, and Mortality for Children Younger than Age 15 Years," <u>Cancer</u>. 58, 1986, pp. 598-602.

VI. OTHER SELECTED CAUSES OF MORTALITY

SEPTICEMIA

This is the first time that septicemia has been featured in this publication, although it has been one of the leading causes of mortality for the past decade. Because of the aging of North Carolina's population, septicemia will continue to be a leading cause of death in years to come.

Septicemia, sometimes called "blood poisoning," is a disease in which the blood is the site of bacterial growth as well as the means of transportation of the infectious agent from one site to another. Because the blood is the growth medium, the spread of septicemia is very rapid, making it an extremely dangerous disease. To compound its seriousness, septicemia may be caused by any one of several types of bacteria, for example, clostridia, bacteroides, and salmonella (1,2).

Five-hundred-thirty-one North Carolinians died from septicemia in 1988. As seen in the following graph, septicemia mortality rates for both whites and nonwhites have risen sharply in recent years, with the exception of 1988. In 1988 the overall rates dropped precipitously, from 10.5 deaths per 100,000 population to 8.2, a decrease of 22 percent.

From 1979-83 to 1984-88 the mortality rate for septicemia rose from 5.2 go 8.9 (a 71 percent increase) while the age-adjusted rate increased by 50 percent. The age-adjusted rates for each race-sex group reveal substantial increases over these five year periods: white males, 40 percent; white females, 73 percent, nonwhite males, 42 percent; and nonwhite females, 50 percent.

SEPTICEMIA MORTALITY RATES BY RACE
NORTH CAROLINA, 1922 — 1988

(RATES HAVE NOT BEEN ADJUSTED FOR DIFFERENCES ARISING
FROM REVISIONS IN CAUSE—OF—DEATH CODING PROCEDURES)
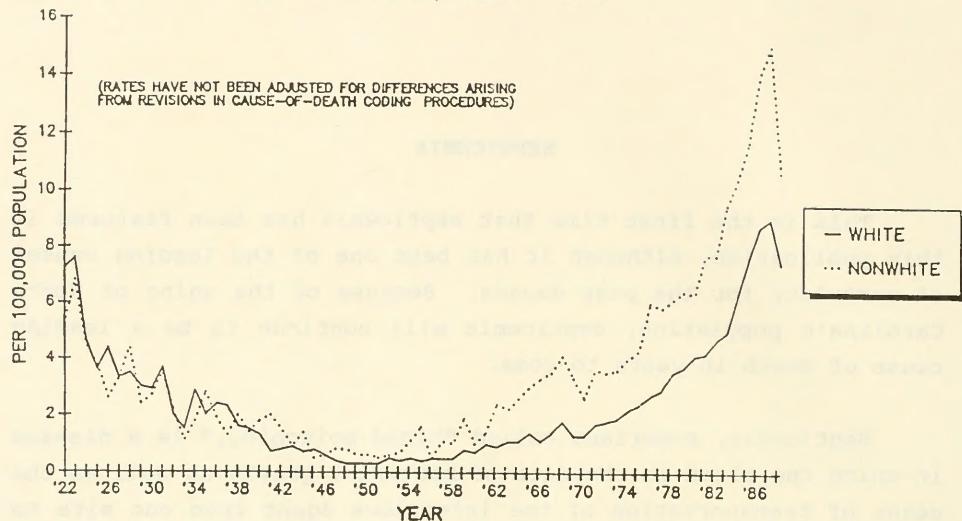
— WHITE
··· NONWHITE

The 1988 unadjusted rate for females was 52 percent higher than for males, and the rate for nonwhites exceeded that for whites by 41 percent. After adjustment for age, nonwhite males had the highest rate, more than twice that of white males and females, and 50 percent greater than nonwhite females.

North Carolina compares unfavorably with the United States in septicemia mortality rates. The age-adjusted rate for N.C. in 1987 was 36 percent higher than the U.S. rate (3).

RISK FACTORS

Primarily at risk for septicemia are the very young and the very old. Nearly 80 percent of septicemia deaths in 1988 were to persons ages 65 and older. Septicemia death rates for children under age five were twice as high as those for persons ages 5-64. The rate for persons ages 85 and older was 113 times as high as those for persons between the ages of five and 65.

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GEOGRAPHIC PATTERNS

County-by-county variations in underlying septicemia rates are not analyzed here, since the total number of deaths is relatively small, and septicemia is much more likely to be reported as a mentioned rather than an underlying condition. In the section of this volume entitled "Multiple Conditions Present at Death," there are county maps showing 1984-88 septicemia mentions per 100,000 population, with an associated discussion of geographic patterns. Data from that section depict three clusters of counties in which residents appear to be at relatively high risk for septicemia, even after adjustment for age, race, and sex variations in county populations.

MORTALITY STATISTICS FOR 1988

NORTH CAROLINA RESIDENTS

SEPTICEMIA

GEOGRAPHICAL AREA	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
NORTH CAROLINA	531	8.18	2825	8.92	8.92
REGIONS					
DHR I WESTERN	170	7.64	834	7.69	7.92
DHR II N. CENTRAL	119	8.72	691	10.35	9.93
DHR III S. CENTRAL	120	7.82	687	9.25	10.09
DHR IV EASTERN	122	8.91	613	9.13	9.03
HSA I WESTERN	96	8.76	433	8.03	7.20
HSA II PIEDMONT	103	8.57	571	9.70	9.68
HSA III S. PIEDMONT	74	6.56	401	7.36	8.01
HSA IV CAPITAL	80	8.25	506	10.92	11.15
HSA V CARDINAL	71	7.29	419	8.76	9.33
HSA VI EASTERN	107	9.55	495	8.98	8.94
COUNTIES					
1 ALAMANCE	7	6.60	54	10.43	9.45
2 ALEXANDER	1	3.62	12	8.91	10.52
3 ALLEGHANY	0	0.00	5	10.23	15.70 *
4 ANSON	3	11.43	12	9.15	6.18
5 ASHE	1	4.25	10	8.56	5.26
6 AVERY	0	0.00	5	6.63	5.10
7 BEAUFORT	4	9.42	19	8.97	7.26
8 BERTIE	2	9.50	11	10.37	9.22
9 BLADEN	5	16.16	27	17.52	13.74
10 BRUNSWICK	1	1.96	12	5.05	4.96
11 BUNCOMBE	16	9.23	76	8.95	7.60
12 BURKE	4	5.17	22	5.78	6.39
13 CABARRUS	10	10.42	46	9.84	10.11
14 CALDWELL	8	11.19	19	5.40	5.85
15 CAMDEN	0	0.00	2	6.77	7.20
16 CARTERET	6	11.75	15	6.08	5.80
17 CASWELL	1	4.50	4	3.59	4.63
18 CATAWBA	9	7.66	39	6.83	7.25
19 CHATHAM	3	8.16	23	12.81	10.76
20 CHEROKEE	3	14.16	12	11.68	12.45
21 CHOWAN	0	0.00	5	7.49	5.59
22 CLAY	0	0.00	1	2.79	1.54
23 CLEVELAND	8	9.18	37	8.59	8.20
24 COLUMBUS	6	11.41	42	16.05	15.27
25 CRAVEN	2	2.45	38	9.51	12.35
26 CUMBERLAND	15	5.89	70	5.49	9.72
27 CURRITUCK	2	14.29	5	7.46	7.07
28 DARE	1	4.65	10	10.67	11.60
29 DAVIDSON	6	4.82	42	6.92	7.86
30 DAVIE	2	7.18	15	11.12	12.86
31 DUPLIN	8	19.20	23	11.05	9.45
32 DURHAM	19	11.07	109	13.17	11.42
33 EDGECOMBE	6	10.01	28	9.50	7.87
34 FORSYTH	36	13.51	169	12.95	12.16
35 FRANKLIN	4	11.28	24	14.19	10.26
36 GASTON	14	8.03	60	6.98	7.33
37 GATES	2	20.42	9	18.89	11.57
38 GRAHAM	2	28.50	5	14.01	21.73*
39 GRANVILLE	3	7.69	32	17.05	13.16
40 GREENE	0	0.00	6	7.27	5.34
41 GUILFORD	23	6.82	124	7.50	7.42

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNCERTAIN.

COUNTIES (CONT'D)	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
42 HALIFAX	10	17.59	42	14.92	11.12
43 HARNETT	3	4.52	22	6.86	7.34
44 HAYWOOD	6	12.43	17	7.07	4.15
45 HENDERSON	2	2.88	20	5.97	6.87
46 HERTFORD	3	12.67	15	12.57	7.25
47 HOKE	2	8.34	10	8.64	7.57
48 HYDE	0	0.00	1	3.41	2.71
49 IREDELL	4	4.36	31	6.98	7.11
50 JACKSON	3	11.09	12	8.92	7.21
51 JOHNSTON	4	4.95	32	8.20	8.01
52 JONES	0	0.00	9	18.25	16.28
53 LEE	2	4.76	18	8.80	9.06
54 LENOIR	6	9.95	27	8.93	8.66
55 LINCOLN	1	2.05	10	4.30	4.96
56 MCDOWELL	3	8.25	14	7.71	6.82
57 MACON	7	29.90	10	8.65	4.96
58 MADISON	3	17.40	15	17.39	10.52
59 MARTIN	5	18.92	17	12.82	10.01
60 MECKLENBURG	29	6.09	181	7.97	8.65
61 MITCHELL	1	6.80	10	13.75	7.81
62 MONTGOMERY	6	24.82	16	13.36	11.63
63 MOORE	3	5.05	21	7.44	5.81
64 NASH	6	8.24	43	12.03	12.57
65 NEW HANOVER	8	6.81	58	10.16	10.45
66 NORTHAMPTON	3	13.56	18	16.06	11.41
67 ONSLOW	6	4.78	19	3.07	7.21
68 ORANGE	5	5.65	47	11.12	14.49
69 PAMLICO	2	18.21	6	10.99	8.61
70 PASQUOTANK	0	0.00	5	3.33	2.80
71 PENDER	0	0.00	6	4.72	5.03
72 PERQUIMANS	0	0.00	6	11.42	7.83
73 PERSON	3	9.54	11	7.17	5.73
74 PITT	10	9.80	50	10.18	10.25
75 POLK	0	0.00	6	8.25	5.05
76 RANDOLPH	8	7.78	31	6.24	7.39
77 RICHMOND	5	10.90	31	13.57	12.46
78 ROBESON	6	5.55	41	7.69	7.08
79 ROCKINGHAM	15	17.34	56	13.07	12.14
80 ROWAN	8	7.51	38	7.29	6.12
81 RUTHERFORD	7	12.10	19	6.64	5.48
82 SAMPSON	6	11.78	32	12.66	10.86
83 SCOTLAND	2	5.76	19	11.17	12.28
84 STANLY	3	5.87	15	5.95	5.84
85 STOKES	1	2.74	18	10.07	12.44
86 SURRY	2	3.22	38	12.39	10.87
87 SWAIN	2	19.01	5	9.39	5.71
88 TRANSYLVANIA	0	0.00	8	6.23	4.00
89 TYRRELL	0	0.00	2	9.72	14.19
90 UNION	5	5.95	20	4.99	5.82
91 VANCE	1	2.54	31	16.02	13.79
92 WAKE	31	7.97	157	8.62	11.26
93 WARREN	5	30.07	22	26.68	16.49
94 WASHINGTON	4	27.32	9	12.36	12.24
95 WATAUGA	2	5.76	14	8.15	7.29
96 WAYNE	12	12.16	34	6.92	7.59
97 WILKES	8	13.02	34	11.16	9.49
98 WILSON	7	10.67	21	6.47	6.92
99 YADKIN	2	6.59	20	13.46	12.33
100 YANCEY	0	0.00	6	7.60	4.77

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

DIABETES MELLITUS

Diabetes Mellitus is one of the chronic noncommunicable diseases that have increased markedly in this century (4). It is a major public health problem and a leading cause of death, disability, and cost in the United States. Since the discovery of insulin and other drugs for lowering hyperglycemia, a reduction in acute complications of diabetes has improved the quality of life of many diabetic patients. An estimated 6.0 million people in the United States have been diagnosed as having diabetes; perhaps another 4.0 million people harbor this syndrome but remain undiagnosed (5). Deaths with diabetes as the underlying cause account for 1.8 percent of the United States mortality and for one percent of potential years of life lost before age 65 (6).

In 1988, a total of 1,326 North Carolinians were reported to have died from diabetes, making it the seventh leading cause of death in the state. These deaths represent a rate of 20.4 deaths per 100,000 population, a 27.8 percent increase over the 1987 rate for diabetes as an underlying cause. In 1987, North Carolina's rate of 16.0 was one percent higher than the United States rate, but after adjustment for age, the state's rate was seven percent higher. In 1986, 19 states had a higher age-adjusted mortality rate (6).

But these figures are unrepresentative of the true proportion of deaths that occur with diabetes. Like hypertension and atherosclerosis, diabetes is an associated condition far more

often than it is the underlying cause of death. In 1988 a total of 4,894 death certificates, representing 8.2 percent of deaths to North Carolina residents had a mention of diabetes. (For further information on mentioned conditions, see Section IX).

As an underlying cause of death in 1984-88, nonwhites had higher age-adjusted rates than whites. The rate for nonwhite males was 2.2 times that for white males, while the nonwhite female rate was 3 times the white female rate. Male and female rates were similar within each race group. From 1979-83 to 1984-88 the age-adjusted death rate with diabetes as the underlying cause increased by four percent in North Carolina. Increases were 12.8 for nonwhite males, 5.8 for nonwhite females, 4.3 for white females, and no change for white males. Based on U.S. data from 1986, only 19 states had a higher age-adjusted mortality rate (6).

Regardless of race or sex, deaths from diabetes mellitus are far more common among the elderly. Looking at 1984-88 deaths in North Carolina age 65 and older, there were 3483 deaths attributed to diabetes for a rate of 95.2. By comparison, the 1984-88 rate for persons of all ages was 15.9. Over two-thirds of deaths from diabetes are to persons age 65 and over.

RISK FACTORS

Factors that are reported to increase the risk of diabetes have varied from one study to another. It is generally found, however, that smoking, hypertension, and being overweight are modifiable risk factors for death among diabetic persons, and estimates of deaths that could be averted by eliminating these risk factors are substantial. Diabetes also contributes to end-stage renal disease, amputations, blindness, and other serious complications; associated risk factors include higher levels of glycemia, smoking, and hypertension. Assuming that

risk-factor reductions among diabetic persons would have the same
benefit as in the general population, more effective control of
smoking, hypertension, and obesity should further decrease
morbidity and mortality rates among diabetic persons. (6)

GEOGRAPHIC PATTERNS

As with septicemia, no attempt is made to assess county-by-
county geographic variations in the underlying-cause diabetes
death rate since diabetes mellitus is much more likely to be
reported as a mentioned rather than an underlying condition. In
Section IX of this volume there are county maps depicting the
1984-88 diabetes mentions, as well as significant clusters of
high-rate counties. These maps suggest that residents of the
central eastern and, to a lesser degree western counties may be
at relatively high risk for diabetes, even after the effects of
age, race, and sex have been controlled.

MORTALITY STATISTICS FOR 1988

NORTH CAROLINA RESIDENTS

OIABETES MELLITUS

GEOGRAPHICAL AREA	NUMBER OF OEATHS 1988	OEATH RATE* 1988	NUMBER OF OEATHS 1984-88	OEATH RATE* 1984-88	ADJUSTED OEATH RATE* 1984-88
NORTH CAROLINA	1326	20.43	5040	15.92	15.92
REGIONS					
DHR I WESTERN	464	20.86	1703	15.71	16.48
OHR II N. CENTRAL	296	21.71	1153	17.28	16.60
DHR III S. CENTRAL	269	17.54	1066	14.35	15.44
OHR 1V EASTERN	297	21.71	1118	16.66	15.57
HSA I WESTERN	237	21.63	859	15.93	17.20
HSA II PIEDMONT	259	21.55	994	16.89	16.96
HSA III S. PIEOMONT	227	20.12	844	15.50	16.45
HSA IV CAPITAL	172	17.74	639	13.79	14.11
HSA V CAROINAL	189	19.42	762	15.94	16.12
HSA VI EASTERN	242	21.61	942	17.09	15.97
COUNTIES					
1 ALAMANCE	41	38.71	118	22.79	19.63
2 ALEXANOER	2	7.25	10	7.43	14.39
3 ALLEGHANY	2	20.36	4	8.18	4.92
4 ANSON	6	22.86	20	15.25	9.64
5 ASHE	5	21.28	19	16.27	26.21*
6 AVERY	3	19.66	9	11.93	9.76
7 BEAUFORT	19	44.77	50	23.62	18.88
8 BERTIE	10	47.53	30	28.30	18.99
9 BLADEN	9	29.09	40	25.95	20.63
10 BRUNSWICK	7	13.73	29	12.21	12.60
11 BUNCOMBE	39	22.51	138	16.25	15.24
12 BURKE	20	25.86	66	17.35	20.17
13 CABARRUS	14	14.59	47	10.05	9.65
14 CALDWELL	19	26.59	62	17.63	22.23
15 CAMDEN	0	0.00	9	30.47	30.32
16 CARTERET	11	21.55	51	20.70	24.04
17 CASWELL	9	40.55	23	20.68	19.21
18 CATAWBA	28	23.86	90	15.77	18.49
19 CHATHAM	8	21.77	19	10.58	9.53
20 CHEROKEE	2	9.44	11	10.71	5.66
21 CHOWAN	4	29.20	14	20.98	12.35
22 CLAY	1	13.74	5	13.98	7.42
23 CLEVELANO	18	20.66	89	20.68	20.19
24 COLUMBUS	16	30.44	43	16.43	14.10
25 CRAVEN	9	11.03	36	9.01	10.89
26 CUMBERLAND	32	12.56	131	10.27	17.45
27 CURRITUCK	5	35.74	17	25.38	24.59
28 OARE	3	13.97	11	11.74	8.93
29 OAVIDSON	19	15.28	86	14.17	17.64
30 OAVIE	4	14.36	18	13.35	13.99
31 OUPLIN	11	26.40	41	19.70	15.78
32 DURHAM	41	23.90	125	15.11	13.52
33 EDGECOMBE	16	26.71	46	15.61	12.06
34 FORSYTH	70	26.28	267	20.46	19.53
35 FRANKLIN	12	33.85	30	17.73	12.83
36 GASTON	37	21.24	119	13.84	15.95
37 GATES	2	20.42	12	25.18	16.69
38 GRAHAM	0	0.00	1	2.80	16.06
39 GRANVILLE	10	25.65	41	21.84	16.12
40 GREENE	4	24.41	16	19.41	16.71
41 GUILFORD	57	16.92	254	15.38	15.27

* SEE SECTION 11; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

COUNTIES (CONT'D)	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
42 HALIFAX	8	14.07	59	20.96	15.70
43 HARNETT	6	9.05	42	13.10	14.04
44 HAYWOOD	13	26.93	36	14.97	9.45
45 HENDERSON	10	14.43	43	12.84	9.89
46 HERTFORD	6	25.34	26	21.80	17.76
47 HOKE	4	16.68	17	14.70	11.33
48 HYDE	0	0.00	4	13.67	12.64
49 IREDELL	13	14.19	66	14.87	13.97
50 JACKSON	6	22.18	23	17.10	24.87
51 JOHNSTON	21	26.03	58	14.86	15.05
52 JONES	2	20.31	9	18.25	12.54
53 LEE	10	23.84	25	12.23	12.31
54 LENOIR	11	18.24	52	17.21	13.69
55 LINCOLN	10	20.58	40	17.23	24.71
56 MCDOWELL	6	16.50	29	15.98	19.64
57 MACON	6	25.63	17	14.71	8.06
58 MADISON	4	23.21	21	24.35	53.80 *
59 MARTIN	12	45.42	35	26.40	19.41
60 MECKLENBURG	104	21.84	365	16.08	17.86
61 MITCHELL	4	27.21	21	28.88	17.95
62 MONTGOMERY	4	16.54	15	12.52	10.99
63 MOORE	8	13.48	40	14.18	11.91
64 NASH	13	17.87	61	17.07	15.83
65 NEW HANOVER	28	23.84	91	15.94	16.20
66 NORTHAMPTON	5	22.61	25	22.31	12.62
67 ONSLOW	10	7.96	37	5.98	13.92
68 ORANGE	10	11.30	45	10.64	13.97
69 PAMLICO	0	0.00	6	10.99	6.83
70 PASQUOTANK	9	29.33	30	20.00	16.86
71 PENDER	4	14.76	13	10.24	8.61
72 PERQUIMANS	2	18.12	3	5.71	3.30
73 PERSON	7	22.27	29	18.91	15.64
74 PITT	26	25.48	87	17.72	18.08
75 POLK	5	33.96	17	23.37	17.96
76 RANDOLPH	23	22.35	63	12.69	15.46
77 RICHMOND	16	34.88	57	24.95	21.75
78 ROBESON	32	29.62	144	27.01	28.46
79 ROCKINGHAM	16	18.50	67	15.64	14.80
80 ROWAN	17	15.95	96	18.43	16.95
81 RUTHERFORD	17	29.40	49	17.14	17.39
82 SAMPSON	12	23.57	43	17.02	13.97
83 SCOTLAND	5	14.40	37	21.75	18.54
84 STANLY	15	29.38	58	23.03	25.49
85 STOKES	4	10.96	18	10.07	10.58
86 SURRY	15	24.15	64	20.87	21.94
87 SWAIN	6	57.04	19	35.70	33.87
88 TRANSYLVANIA	5	19.09	17	13.24	22.84
89 TYRRELL	2	48.84	3	14.59	10.37
90 UNION	17	20.23	53	13.23	15.97
91 VANCE	7	17.82	45	23.26	17.97
92 WAKE	45	11.58	208	11.42	14.85
93 WARREN	1	6.01	14	16.98	8.26
94 WASHINGTON	1	6.83	10	13.74	11.24
95 WATAUGA	4	11.53	13	7.57	16.78
96 WAYNE	23	23.32	96	19.54	19.45
97 WILKES	9	14.65	35	11.49	14.84
98 WILSON	18	27.44	66	20.34	19.79
99 YADKIN	1	3.29	16	10.77	7.75
100 YANCEY	3	18.73	15	19.01	13.26

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

PNEUMONIA AND INFLUENZA

In 1988 a total of 1,930 North Carolinians died from pneumo-
nia (viral and bacterial) or influenza. The crude mortality rate
of 29.8 deaths per 100,000 population in 1988 was up 18 percent
from 25.2 in 1987. A comparison of the five-year period 1979-83
to 1984-88 reveals that the pneumonia and influenza rate rose 26
percent, from 21.4 to 27.0.

After adjusting for age, the upward trend in pneumonia and
influenza mortality rates is dampened significantly. Less than
an eight percent increase is noted when comparing 1979-83 to
1984-88 age-adjusted rates, suggesting that much of the increase
in unadjusted rates was due to changes in the age structure of
the population. North Carolina's elderly population has grown
more rapidly than the rest of its population, and is expected to
double in the thirty years from 1980 to 2010 (7).

The rate of pneumonia and influenza mortality increases with
age, regardless of race or sex. In the period 1984-88 nearly 85
percent of such deaths were to persons 65 and older.

While the nonwhite male age-adjusted rate for 1984-88 was
the highest of the race-sex-specific rates, it represented the
smallest increase from 1979-83 to 1984-88 (4.8 percent). Non-
white females increased the most, rising 16.7 percent. White
male and female age-adjusted rates increased eight and nine
percent, respectively.

The 1987 age-adjusted mortality rate for pneumonia and

influenza was 1.5 percent below the United States rate (3).

North Carolina's age-adjusted race-sex-specific rates for non-white males and females were somewhat higher than national averages, while state white rates were slightly lower.

Pneumonia and influenza was the sixth leading cause of death in 1988 when ranked on the basis of unadjusted mortality rates. Race-sex-specific rankings reveal that pneumonia and influenza was the sixth leading cause of death for white males (30.7 deaths per 100,000), fourth for white females (32.9), sixth for nonwhite males (29.5), and sixth for nonwhite females (17.8). Pneumonia and influenza was North Carolina's tenth leading cause of potential years of life lost, accounting for 139 years lost per 100,000 population.

RISK FACTORS

Persons most at risk of dying from pneumonia or influenza are those over age 50, those with chronic diseases of the heart, liver, lungs, kidneys, or those with diabetes (8). Respiratory infections in the form of pneumonia or pneumonitis are also common in the neonatal period and a significant cause of morbidity and mortality in the newborn (9).

GEOGRAPHIC PATTERNS

Figures 10.A and 10.B depict the county unadjusted and age-race-sex-adjusted 1984-88 rates for pneumonia and influenza. As shown in Figure 10.A, most of the 100 North Carolina counties have relatively low unadjusted mortality rates. Madison, Mitchell, and Alleghany in the Western DHR region have high rates, however, as have Stokes and Warren in the North Central, Anson in the South Central, and Chowan in the Eastern Region. Overall pneumonia and influenza unadjusted mortality rates were the

highest in the North Central DHR Region (35.3) and the Western Region (31.8).

After adjusting for age, race, and sex differences (see Figure 10.B), Stokes, Alleghany, Warren, Anson, Chowan, and Camden exhibited rates in the two highest levels. In short, high rate occurs in mostly rural counties and cannot be attributed to the age-race-sex distributions in these counties. Also, the high rates noted in Anson, Stokes, and Warren counties have persisted since 1979-81 (10).

When using the procedures outlined in Section II, geographic clusters of the counties' high unadjusted pneumonia and influenza mortality rates are not statistically significant. Similarly, adjusting for age, race, and sex does not reveal any meaningful clustering among the counties. This result is consistent with earlier findings (10).

MORTALITY STATISTICS FOR 1988

NORTH CAROLINA RESIDENTS

PNEUMONIA AND INFLUENZA

GEOGRAPHICAL AREA	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
NORTH CAROLINA	1930	29.74	8538	26.98	26.98
REGIONS					
OHR I WESTERN	708	31.84	3155	29.11	26.63
OHR II N. CENTRAL	481	35.28	1971	29.54	27.78
OHR III S. CENTRAL	379	24.72	1635	22.01	26.27
OHR IV EASTERN	362	26.46	1777	26.48	27.78
HSA I WESTERN	365	33.31	1753	32.51	27.16
HSA II PIEDMONT	411	34.20	1679	28.53	27.28
HSA III S. PIEDMONT	343	30.41	1402	25.75	26.23
HSA IV CAPITAL	253	26.09	1137	24.55	26.97
HSA V CARDINAL	260	26.72	1102	23.06	26.85
HSA VI EASTERN	298	26.61	1465	26.58	27.94
COUNTIES					
1 ALAMANCE	21	19.82	99	19.12	16.52
2 ALEXANDER	9	32.65	39	28.97	35.50
3 ALLEGHANY	6	61.10	40	81.87	44.17
4 ANSON	18	68.60	76	57.95	46.07
5 ASHE	7	29.80	30	25.70	14.66
6 AVERY	7	45.88	27	35.81	30.24
7 BEAUFORT	17	40.06	81	38.27	32.54
8 BERTIE	6	28.51	37	34.90	26.74
9 BLADEN	12	38.79	52	33.74	34.44
10 BRUNSWICK	12	23.54	71	29.89	30.79
11 BUNCOMBE	69	39.83	342	40.27	28.94
12 BURKE	24	31.04	86	22.61	26.17
13 CABARRUS	54	56.28	177	37.87	33.96
14 CALDWELL	22	30.79	85	24.17	28.80
15 CAMDEN	2	33.01	13	44.01	43.03
16 CARTERET	10	19.59	53	21.51	21.44
17 CASWELL	6	27.03	28	25.17	26.55
18 CATAWBA	33	28.12	147	25.76	28.77
19 CHATHAM	13	35.38	54	30.09	26.23
20 CHEROKEE	8	37.76	31	30.19	16.66
21 CHOWAN	7	51.11	40	59.94	42.28
22 CLAY	3	41.24	15	41.95	21.41
23 CLEVELAND	23	26.40	102	23.70	22.40
24 COLUMBUS	24	45.66	97	37.08	35.62
25 CRAVEN	12	14.70	64	16.02	23.44
26 CUMBERLAND	42	16.49	155	12.16	25.47
27 CURRITUCK	2	14.29	18	26.87	27.47
28 DARE	6	27.95	25	26.69	26.93
29 DAVIDSON	30	24.13	149	24.56	25.93
30 DAVIE	6	21.54	34	25.22	26.71
31 DUPLIN	7	16.80	49	23.55	20.97
32 DURHAM	44	25.65	241	29.13	28.31
33 EDGECOMBE	19	31.72	106	35.98	31.20
34 FORSYTH	101	37.91	363	27.82	26.36
35 FRANKLIN	10	28.21	38	22.46	18.63
36 GASTON	52	29.85	220	25.59	27.46
37 GATES	7	71.50	19	39.87	35.54
38 GRAHAM	3	42.75	8	22.43	38.92*
39 GRANVILLE	15	38.48	74	39.42	36.54
40 GREENE	5	30.51	16	19.41	20.28
41 GUILFORD	132	39.18	501	30.33	28.77

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

MORTALITY STATISTICS FOR 1988, NORTH CAROLINA RESIDENTS
PNEUMONIA AND INFLUENZA CONT'D.

COUNTIES (CONT'D)	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
42 HALIFAX	22	38.70	84	29.84	26.10
43 HARNETT	14	21.12	81	25.27	27.34
44 HAYWOOD	20	41.43	96	39.94	27.17
45 HENDERSON	27	38.98	140	41.82	25.53
46 HERTFORD	3	12.67	37	31.02	20.51
47 HOKE	5	20.85	25	21.61	36.76
48 HYDE	2	35.22	7	23.93	16.44
49 IREDELL	33	36.02	146	32.89	29.07
50 JACKSON	14	51.75	50	37.18	34.20
51 JOHNSTON	25	30.99	102	26.14	26.43
52 JONES	2	20.31	12	24.33	23.37
53 LEE	10	23.84	42	20.55	21.28
54 LENOIR	19	31.51	70	23.16	23.47
55 LINCOLN	9	18.52	51	21.97	21.47
56 MCDOWELL	10	27.51	47	25.90	23.75
57 MACON	4	17.09	36	31.15	29.02
58 MADISON	10	58.03	43	49.86	35.54
59 MARTIN	10	37.85	42	31.68	27.78
60 MECKLENBURG	110	23.10	453	19.96	22.79
61 MITCHELL	4	27.21	44	60.52	33.15
62 MONTGOMERY	10	41.37	42	35.07	29.33
63 MOORE	27	45.51	86	30.49	22.65
64 NASH	15	20.62	113	31.63	31.41
65 NEW HANOVER	18	15.32	112	19.62	21.46
66 NORTHAMPTON	11	49.75	44	39.27	37.18
67 ONSLOW	17	13.54	70	11.31	29.30
68 ORANGE	15	16.95	75	17.74	23.31
69 PAMLICO	3	27.32	22	40.30	27.42
70 PASQUOTANK	8	26.07	46	30.67	27.03
71 PENDER	10	36.92	32	25.21	22.13
72 PERQUIMANS	8	72.50	22	41.89	27.36
73 PERSON	18	57.28	50	32.60	28.91
74 PITT	21	20.58	123	25.05	29.93
75 POLK	4	27.17	26	35.75	21.38
76 RANDOLPH	22	21.41	93	18.74	22.18
77 RICHMOND	10	21.80	61	26.71	24.89
78 ROBESON	37	34.25	113	21.20	24.87
79 ROCKINGHAM	32	37.00	159	37.12	35.00
80 ROWAN	50	46.94	199	38.22	28.88
81 RUTHERFORD	21	36.32	118	41.29	31.97
82 SAMPSON	14	27.50	66	26.12	23.87
83 SCOTLAND	7	20.17	33	19.40	22.01
84 STANLY	17	33.30	64	25.42	20.73
85 STOKES	21	57.55	87	48.68	51.08
86 SURRY	27	43.47	99	32.28	23.51
87 SWAIN	4	38.03	15	28.18	18.34
88 TRANSYLVANIA	4	15.27	38	29.61	22.32
89 TYRRELL	3	73.26	8	38.91	32.21
90 UNION	18	21.42	92	22.98	27.51
91 VANCE	19	48.38	79	40.84	34.19
92 WAKE	76	19.56	331	18.17	25.48
93 WARREN	8	48.12	51	61.86	46.75
94 WASHINGTON	5	34.15	23	31.60	34.91
95 WATAUGA	11	31.72	36	20.97	21.78*
96 WAYNE	25	25.34	110	22.39	26.27
97 WILKES	17	27.67	89	29.21	27.85
98 WILSON	24	36.59	111	34.22	37.00
99 YADKIN	13	42.87	67	45.11	34.58
100 YANCEY	1	6.24	23	29.16	17.23

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

PNEUMONIA AND INFLUENZA

MORTALITY RATES PER 100,000 POPULATION

- ■ 81.87 to 81.87
- ■ 57.95 to 61.86
- ▨ 48.68 to 49.87
- ▨ 33.74 to 45.11
- □ 16.02 to 32.90
- □ 11.31 to 12.16

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
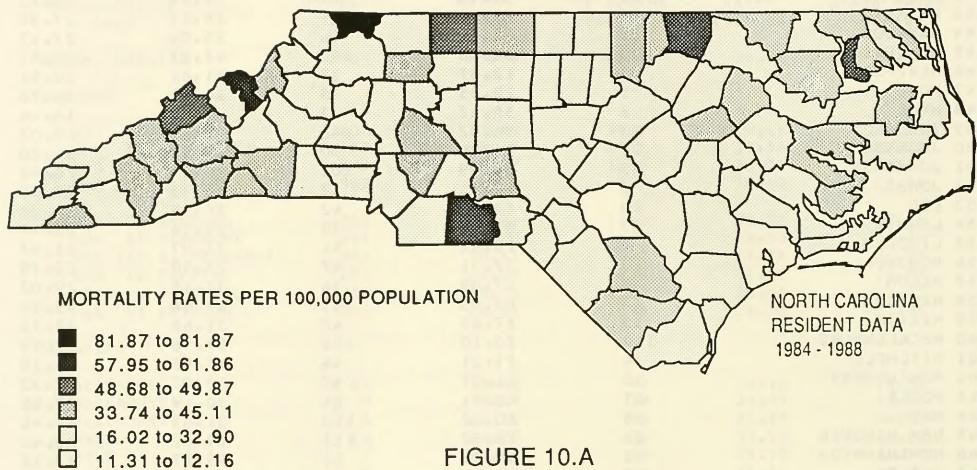
FIGURE 10.A

PNEUMONIA AND INFLUENZA

AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 POPULATION

- ■ 51.08 to 51.08
- ■ 42.28 to 46.76
- ▨ 29.94 to 38.93
- ▨ 24.87 to 29.33
- □ 20.28 to 23.87
- □ 14.67 to 18.63

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
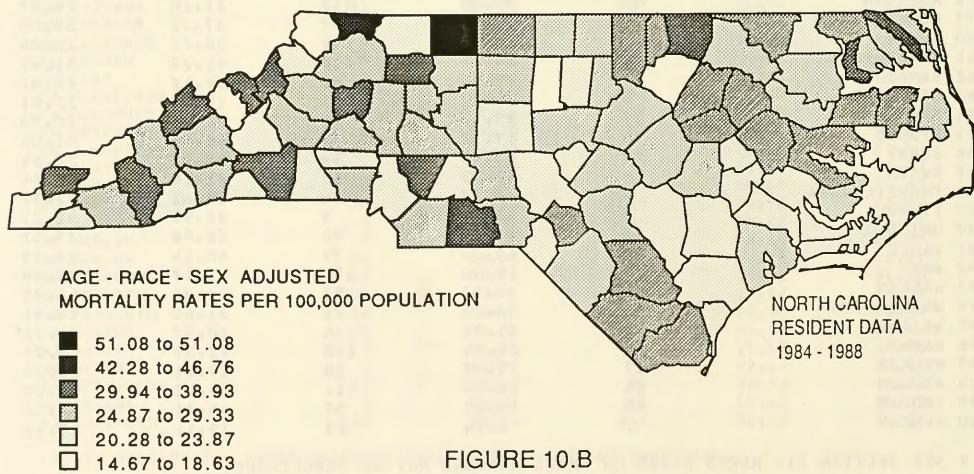
FIGURE 10.B

CHRONIC OBSTRUCTIVE PULMONARY DISEASE AND ALLIED CONDITIONS

In 1988 a total of 2,098 North Carolinians died from chronic obstructive pulmonary disease or one of its allied conditions (i.e., bronchitis, emphysema, asthma, and other chronic obstructive pulmonary diseases and allied conditions). The rate of 32.3 deaths per 100,000 population was up 15 percent from 28.1 in 1987. This increase is similarly evident when one compares the five-year period 1979-83 to 1984-38; the crude mortality rate for chronic obstructive pulmonary disease (COPD) increased 28 percent from 21.9 to 28.1. This upward trend contrasts with declines or stabilizations in rates for many other leading causes of death.

Even when adjusting for age, mortality rates have risen substantially since the five-year period 1979-83, up 15.5 percent in 1984-88. The largest increases were for white females (up 42 percent), nonwhite males (up 20 percent), and nonwhite females (up 21 percent). As white males have accounted for over half of COPD deaths since 1980, their relatively modest three percent rise offset the other increases to some extent.

The 1987 North Carolina age-adjusted mortality rate for COPD was six percent below the United States rate (3). In 1986 35 states ranked higher than North Carolina in smoking-related obstructive pulmonary disease mortality (11).

COPD was the fifth leading cause of death in 1988, moving up from sixth place in 1980. An examination of the 1988 race-sex-specific rates rankings (unadjusted for age) reveals that COPD was the fifth leading cause of death for white males (46.7),

sixth for white females (28.5), seventh for nonwhite males (27.6), and thirteenth for nonwhite females (7.3). COPD was North Carolina's seventh leading cause of potential years of life lost, accounting for 156 years lost per 100,000 population.

Rates of COPD mortality increase with age. In the period 1984-88 over 77 percent of such deaths were to persons 65 and older.

RISK FACTORS

Evidence over the past 25 years indicates that cigarette smoking is the most important risk factor for the development of chronic bronchitis and obstructive airways disease. While there is no way to reverse or repair COPD damage to the airways and lungs, treatment is aimed at slowing the progress of the disease and lessening the discomfort of the symptoms (12). Occupational exposure to various dusts and air pollution have also been implicated as risk factors (10).

That COPD mortality is increasing would seem to be inconsistent with the significant decline in the prevalence of smoking since the first Surgeon General's Report on the Health Consequences of Smoking in 1964. The lengthy period of latency between smoking exposure and COPD onset explains this seeming inconsistency (11).

GEOGRAPHIC PATTERNS

Figures 11.A and 11.B depict the county unadjusted and age-race-sex-adjusted 1984-88 rates for COPD. As shown in Figure 11.A, most of the 100 North Carolina counties have relatively low mortality rates (lowest three levels). Twelve counties concentrated in the westernmost portion of the DHR Western Region had high rates, as did two North Central counties, three South

Central counties, and three in the Eastern Region.

After adjusting for age, race, and sex differences, the pattern of COPD mortality changes. Only seven of the 12 counties in the Western Region still had relatively high rates. However, a 26-county contiguous area from Montgomery and Richmond in the South Central to Bertie and Washington in the Eastern Region exhibited rates in the three highest levels. Seven counties in the North Central Region also had high adjusted rates. The basic geographic pattern of high adjusted and unadjusted rates is similar to that observed in 1979-81, although more contiguous counties are involved (10).

Procedures described in Section II were used to test whether clustering of counties with high unadjusted and/or age-race-sex adjusted rates was statistically significant. An examination of the map below shows significant clustering of 12 high unadjusted rate counties in the westernmost portion of the DHR Western Region, with additional small clusters elsewhere.

CHRONIC OBSTRUCTIVE PULMONARY DISEASES

MORTALITY RATES PER 100,000 POPULATION

- 39.85 to 59.15 (p<=.01)
- 36.25 to 39.42 (p<=.05)
- 12.96 to 36.04

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
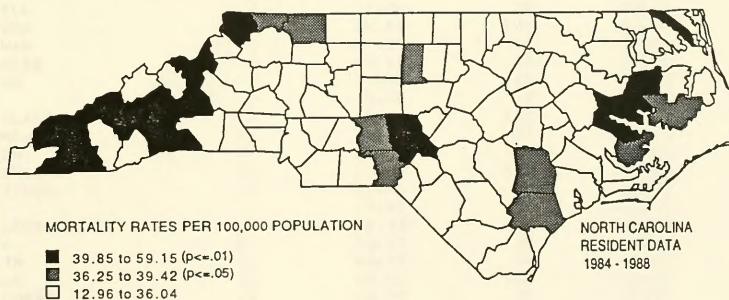
After adjusting for age, race, and sex, the pattern of clustering changes, as shown on the following map. A three-county cluster remains in the west, while the number of adjacent high-rate counties in the east and south has increased. These data suggest that age-race-sex differences may account for most clustering of high rate western counties, but these variables cannot explain the clustering that occurs among counties in the east and southeast.

CHRONIC OBSTRUCTIVE PULMONARY DISEASES

AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 POPULATION

NORTH CAROLINA
RESIDENT DATA
1984 - 1988

■ 36.65 to 48.01 (p<=.05)
▨ 35.18 to 36.52 (p<=.05)
▢ 33.42 to 34.90 (p<=.05)
□ 12.94 to 32.92
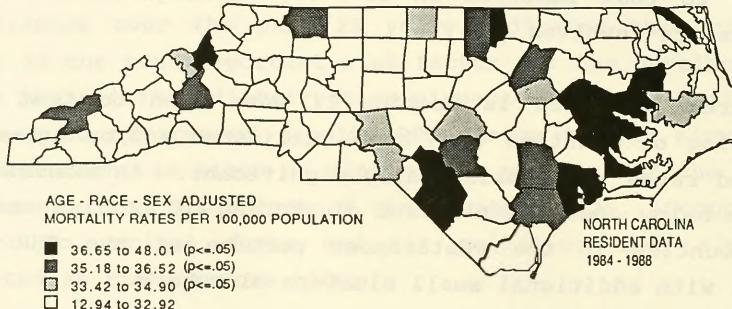
M O R T A L I T Y   S T A T I S T I C S   F O R   1 9 8 8

N O R T H   C A R O L I N A   R E S I D E N T S

C H R O N I C   O B S T R U C T I V E   P U L M O N A R Y   D I S E A S E S

GEOGRAPHICAL AREA	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
NORTH CAROLINA	2098	32.33	8883	28.07	28.07
REGIONS					
DHR I WESTERN	740	33.28	3202	29.54	26.46
DHR II N. CENTRAL	487	35.72	2022	30.31	28.51
DHR III S. CENTRAL	423	27.59	1751	23.57	29.11
DHR IV EASTERN	448	32.75	1908	28.44	30.80
HSA I WESTERN	443	40.43	1888	35.01	28.46
HSA II PIEDMONT	438	36.45	1787	30.36	28.70
HSA III S. PIEDMONT	297	26.33	1314	24.13	24.24
HSA IV CAPITAL	237	24.44	1047	22.61	26.59
HSA V CARDINAL	317	32.57	1268	26.53	30.94
HSA VI EASTERN	366	32.68	1579	28.64	31.61
COUNTIES					
1 ALAMANCE	63	59.48	204	39.41	32.59
2 ALEXANDER	6	21.76	28	20.80	22.76
3 ALLEGHANY	3	30.55	18	36.84	21.41
4 ANSON	8	30.48	17	12.96	12.94
5 ASHE	9	38.31	57	48.83	28.39
6 AVERY	15	98.33	39	51.73	40.53
7 BEAUFORT	23	54.20	90	42.53	37.87
8 BERTIE	9	42.77	31	29.24	32.31
9 BLADEN	14	45.26	39	25.30	25.77
10 BRUNSWICK	12	23.54	57	24.00	23.03
11 BUNCOMBE	86	49.65	352	41.45	32.71
12 BURKE	27	34.92	112	29.45	27.46
13 CABARRUS	31	32.31	144	30.81	26.66
14 CALDWELL	19	26.59	95	27.02	29.03
15 CAMDEN	7	115.56	13	44.01	40.00
16 CARTERET	13	25.47	81	32.88	26.85
17 CASWELL	8	36.04	36	32.36	33.67
18 CATAWBA	30	25.56	135	23.65	23.63
19 CHATHAM	14	38.10	42	23.40	21.09
20 CHEROKEE	5	23.60	37	36.04	23.98
21 CHOWAN	5	36.50	21	31.47	25.81
22 CLAY	0	0.00	17	47.54	25.79
23 CLEVELAND	27	30.99	130	30.21	27.82
24 COLUMBUS	16	30.44	73	27.90	27.33
25 CRAVEN	27	33.09	105	26.29	37.10
26 CUMBERLAND	46	18.06	220	17.26	36.07
27 CURRITUCK	5	35.74	18	26.87	27.76
28 DARE	3	13.97	21	22.42	19.38
29 DAVIDSON	39	31.37	171	28.19	27.61
30 DAVIE	14	50.27	36	26.71	25.50
31 DUPLIN	20	48.01	79	37.97	35.33
32 DURHAM	32	18.66	168	20.31	23.04
33 EDGECOMBE	18	30.05	75	25.45	29.97
34 FORSYTH	112	42.04	419	32.11	31.86
35 FRANKLIN	8	22.57	38	22.46	20.45
36 GASTON	50	28.70	226	26.29	25.33
37 GATES	3	30.64	13	27.28	22.41
38 GRAHAM	3	42.75	17	47.66	30.91
39 GRANVILLE	12	30.78	61	32.50	35.17
40 GREENE	5	30.51	24	29.11	32.73
41 GUILFORD	101	29.98	469	28.39	27.99

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

COUNTIES (CONT'D)	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
42 HALIFAX	18	31.66	96	34.10	31.13
43 HARNETT	24	36.20	99	30.89	33.95
44 HAYWOOD	27	55.93	121	50.34	30.53
45 HENDERSON	44	63.53	158	47.20	28.12
46 HERTFORD	7	29.57	32	26.83	26.68
47 HOKE	10	41.71	29	25.07	48.01
48 HYDE	4	70.45	11	37.61	33.45
49 IREDELL	27	29.47	104	23.43	20.70
50 JACKSON	7	25.87	39	29.00	26.45
51 JOHNSTON	29	35.95	111	28.45	27.33
52 JONES	4	40.62	16	32.45	31.58
53 LEE	11	26.22	62	30.34	31.83
54 LENOIR	22	36.48	75	24.82	26.10
55 LINCOLN	6	12.34	47	20.25	21.08
56 MCDOWELL	20	55.03	76	41.89	36.50
57 MACON	10	42.72	48	41.54	19.98
58 MADISON	6	34.81	21	24.35	15.48
59 MARTIN	11	41.63	42	31.68	29.39
60 MECKLENBURG	115	24.15	526	23.17	27.35
61 MITCHELL	11	74.83	43	59.14	33.42
62 MONTGOMERY	10	41.37	47	39.25	34.61
63 MOORE	31	52.26	120	42.55	30.91
64 NASH	17	23.37	126	35.27	36.44
65 NEW HANOVER	40	34.06	153	26.80	28.73
66 NORTHAMPTON	7	31.66	27	24.09	18.93
67 ONSLOW	23	18.32	103	16.65	39.13
68 ORANGE	15	16.95	70	16.56	22.59
69 PAMLICO	4	36.42	20	36.64	28.62
70 PASQUOTANK	11	35.85	28	18.66	18.51
71 PENDER	14	51.69	46	36.24	35.75
72 PERQUIMANS	6	54.38	16	30.47	20.32
73 PERSON	9	28.64	46	29.99	26.99
74 PITT	31	30.39	152	30.96	40.61
75 POLK	9	61.13	31	42.63	26.08
76 RANDOLPH	29	28.22	99	19.95	17.96
77 RICHMOND	21	45.79	89	38.97	34.90
78 ROBESON	43	39.80	153	28.70	36.65
79 ROCKINGHAM	26	30.06	145	33.85	30.75
80 ROWAN	39	36.61	154	29.57	22.92
81 RUTHERFORD	27	46.70	100	34.99	26.15
82 SAMPSON	19	37.33	84	33.25	30.35
83 SCOTLAND	9	25.93	42	24.69	31.69
84 STANLY	11	21.54	53	21.05	16.03
85 STOKES	10	27.40	45	25.18	24.83
86 SURRY	25	40.25	120	39.13	35.85
87 SWAIN	7	66.55	23	43.22	36.52
88 TRANSYLVANIA	14	53.45	39	30.39	22.78
89 TYRRELL	1	24.42	6	29.18	27.42
90 UNION	18	21.42	60	14.98	16.65
91 VANCE	15	38.19	68	35.15	37.35
92 WAKE	87	22.39	359	19.71	28.46
93 WARREN	5	30.07	22	26.68	23.64
94 WASHINGTON	7	47.81	29	39.85	42.30
95 WATAUGA	10	28.84	34	19.81	25.49*
96 WAYNE	37	37.51	131	26.66	32.92
97 WILKES	20	32.55	96	31.51	29.06
98 WILSON	18	27.44	98	30.21	33.86
99 YADKIN	11	36.27	43	28.95	19.78
100 YANCEY	1	6.24	22	27.89	16.54

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

CHRONIC OBSTRUCTIVE PULMONARY DISEASES

MORTALITY RATES PER 100,000 POPULATION

- ■ 59.15 to 59.15
- ■ 47.20 to 51.74
- ▨ 38.97 to 44.01
- ▨ 33.86 to 37.97
- ☐ 22.42 to 33.26
- ☐ 12.96 to 21.05

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
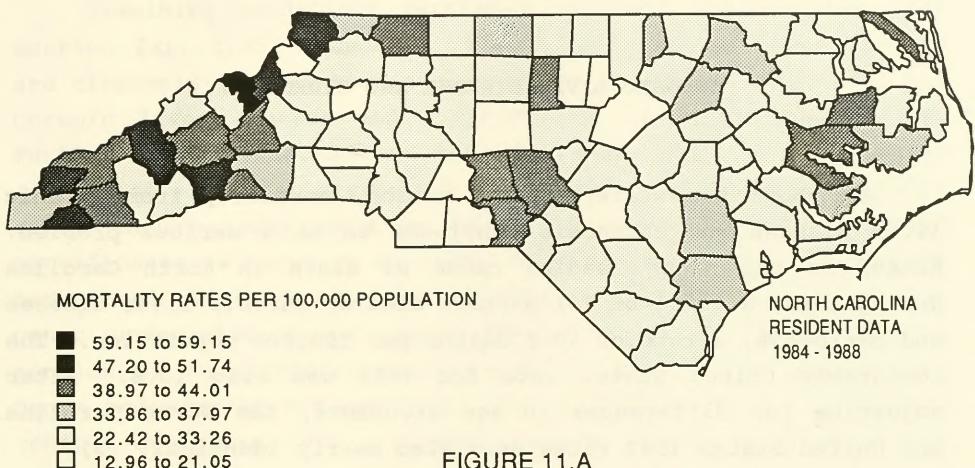
FIGURE 11.A

CHRONIC OBSTRUCTIVE PULMONARY DISEASES

AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 POPULATION

- ■ 48.01 to 48.01
- ■ 39.14 to 42.31
- ▨ 29.97 to 37.87
- ▨ 24.84 to 29.40
- ☐ 17.97 to 23.99
- ☐ 12.94 to 16.65

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
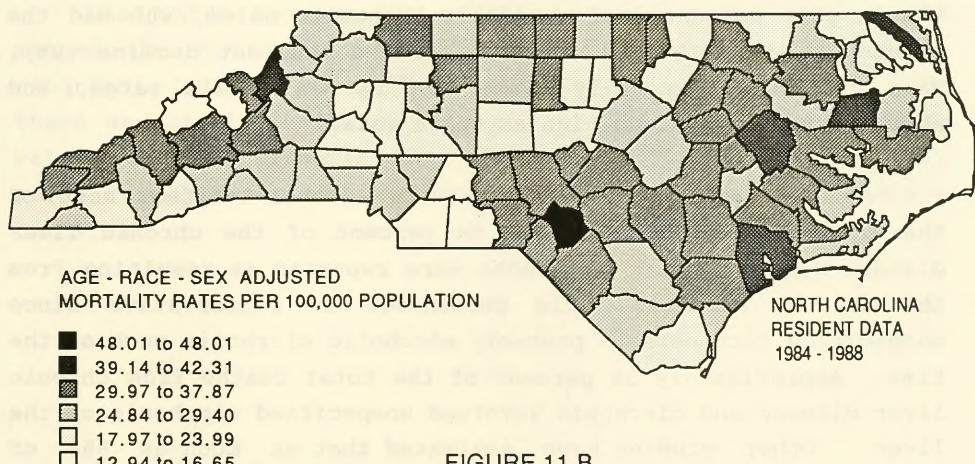
FIGURE 11.B

CHRONIC LIVER DISEASE AND CIRRHOSIS

For both the state and the nation, mortality from chronic liver disease and cirrhosis continues to be a serious problem. Ranked as the ninth leading cause of death in North Carolina during 1988, a total of 701 persons died of chronic liver disease and cirrhosis, a rate of 10.8 deaths per 100,000 population. The comparable United States rate for 1987 was also 10.8. After adjusting for differences in age structure, the North Carolina and United States 1987 rates were also nearly identical. (3)

Recent trends indicate that the risk of chronic liver disease and cirrhosis mortality has declined. Comparing age-adjusted rates in the 1979-83 and 1984-88 periods, cirrhosis mortality decreased by 15 percent. Each race-sex group experienced declines between the two periods, with white males showing the largest percent decline (20%). Nonwhite males, who had the highest rate in 1984-88, experienced the smallest decline (9%). Male rates are generally twice as high as female rates, and nonwhite rates twice as high as white rates.

Although cirrhosis is not always alcohol-related, most of the cases are. In 1988 about 54 percent of the chronic liver disease deaths to N.C. residents were reported as resulting from the use of alcohol. This percentage is conservative since unspecified cirrhosis is probably alcoholic cirrhosis much of the time. Approximately 38 percent of the total deaths from chronic liver disease and cirrhosis involved unspecified cirrhosis of the liver. Other studies have estimated that as much as 85% of

chronic liver disease and cirrhosis deaths can be attributed to alcohol abuse (13).

Examining conditions mentioned on death certificates (see Section IX), 1,052 decedents in 1988 had chronic liver disease and cirrhosis as a mentioned condition. Of these, 66 percent had chronic liver disease and cirrhosis as the underlying cause. Further, 1,634 decedents had an alcohol-related condition (including alcoholic cirrhosis) mentioned on their death certifi- cate, though underreporting of alcohol involvement on death certificates is known to be high. Of these decedents, 23 percent had chronic liver disease and cirrhosis as the underlying cause. Other underlying causes (with percent) for decedents with a mention of an alcohol-related condition were: all other acci- dents and adverse effects (13%), heart disease (14%), and motor vehicle accidents (9%). Notable also are findings that almost half of the known decedents with an alcohol-related condition died from an accident or cirrhosis of the liver.

GEOGRAPHIC PATTERNS

Unadjusted and age-race-sex-adjusted rates for 1984-88 are mapped in Figures 12.A and 12.B respectively. No clear geographic pattern is evident from these maps. Neither were there any statistically significant adjacencies among the high- rate counties, although counties with high rates are mostly rural. Problems of alcohol abuse are spread all across North Carolina.

MORTALITY STATISTICS FOR 1988

NORTH CAROLINA RESIDENTS

CHRONIC LIVER DISEASE AND CIRRHOSIS

GEOGRAPHICAL AREA	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
NORTH CAROLINA	701	10.80	3169	10.01	10.01
REGIONS					
DHR I WESTERN	234	10.52	1049	9.68	10.12
DHR II N. CENTRAL	148	10.85	690	10.34	9.89
DHR III S. CENTRAL	168	10.96	680	9.15	9.86
DHR IV EASTERN	151	11.03	750	11.18	11.22
HSA I WESTERN	110	10.03	524	9.71	10.63
HSA II PIEDMONT	131	10.90	611	10.38	10.17
HSA III S. PIEDMONT	124	10.99	525	9.64	9.86
HSA IV CAPITAL	98	10.10	390	8.42	8.80
HSA V CARDINAL	119	12.22	508	10.63	11.19
HSA VI EASTERN	119	10.62	611	11.08	11.22
COUNTIES					
1 ALAMANCE	13	12.27	55	10.62	9.33
2 ALEXANDER	2	7.25	7	5.20	6.68
3 ALLEGHANY	0	0.00	4	8.18	28.90 *
4 ANSON	2	7.62	12	9.15	8.52
5 ASHE	3	12.77	6	5.14	3.66
6 AVERY	2	13.11	12	15.91	26.52 *
7 BEAUFORT	5	11.78	32	15.12	14.36
8 BERTIE	2	9.50	9	8.49	8.18
9 BLADEN	5	16.16	10	6.48	6.19
10 BRUNSWICK	10	19.62	33	13.89	13.09
11 BUNCOMBE	15	8.66	85	10.01	9.81
12 BURKE	7	9.05	43	11.30	13.39
13 CABARRUS	8	8.33	43	9.20	8.77
14 CALDWELL	4	5.59	26	7.39	10.32
15 CAMDEN	0	0.00	1	3.38	2.29
16 CARTERET	5	9.79	31	12.58	10.64
17 CASWELL	0	0.00	10	8.99	9.52
18 CATAWBA	8	6.81	51	8.93	9.20
19 CHATHAM	2	5.44	6	3.34	3.12
20 CHEROKEE	4	18.88	18	17.53	15.85
21 CHOWAN	0	0.00	5	7.49	7.08
22 CLAY	0	0.00	5	13.98	10.19
23 CLEVELAND	14	16.07	57	13.24	13.35
24 COLUMBUS	4	7.61	21	8.02	7.14
25 CRAVEN	3	3.67	30	7.51	9.65
26 CUMBERLAND	24	9.42	123	9.65	13.40
27 CURRITUCK	3	21.44	7	10.45	9.79
28 DARE	0	0.00	10	10.67	9.11
29 DAVIDSON	6	4.82	47	7.74	7.66
30 DAVIE	2	7.18	8	5.93	5.86
31 DUPLIN	6	14.40	23	11.05	10.53
32 DURHAM	25	14.57	83	10.03	9.76
33 EDGECOMBE	9	15.02	47	15.95	14.37
34 FORSYTH	37	13.89	180	13.79	13.10
35 FRANKLIN	2	5.64	18	10.64	10.31
36 GASTON	29	16.64	121	14.07	15.07
37 GATES	1	10.21	6	12.59	15.26
38 GRAHAM	1	14.25	3	8.41	6.20
39 GRANVILLE	4	10.26	12	6.39	4.94
40 GREENE	1	6.10	8	9.70	8.82
41 GUILFORD	35	10.39	155	9.38	9.06

* SEE SECTION 11: RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

COUNTIES (CONT'D)	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
42 HALIFAX	21	36.94	51	18.12	14.71
43 HARNETT	10	15.08	24	7.48	7.88
44 HAYWOOD	9	18.64	26	10.81	7.57
45 HENDERSON	11	15.88	34	10.15	6.56
46 HERTFORD	3	12.67	18	15.09	13.73
47 HOKE	1	4.17	8	6.91	7.60
48 HYDE	0	0.00	6	20.51	23.17
49 IREDELL	10	10.91	41	9.23	9.03
50 JACKSON	3	11.09	14	10.41	12.15
51 JOHNSTON	11	13.63	43	11.02	10.78
52 JONES	0	0.00	6	12.16	9.16
53 LEE	7	16.69	29	14.19	14.30
54 LENOIR	7	11.60	39	12.90	11.98
55 LINCOLN	5	10.29	18	7.75	8.06
56 MCDOWELL	8	22.01	20	11.02	10.13
57 MACON	1	4.27	9	7.78	4.16
58 MADISON	0	0.00	4	4.63	3.65
59 MARTIN	2	7.57	15	11.31	9.36
60 MECKLENBURG	57	11.97	205	9.03	9.01
61 MITCHELL	2	13.60	10	13.75	9.81
62 MONTGOMERY	4	16.54	10	8.35	7.90
63 MOORE	14	23.60	55	19.50	17.07
64 NASH	7	9.62	43	12.03	11.96
65 NEW HANOVER	14	11.92	70	12.26	12.65
66 NORTHAMPTON	5	22.61	15	13.38	9.45
67 ONSLOW	3	2.39	38	6.14	10.41
68 ORANGE	6	6.78	26	6.15	8.25
69 PAMLICO	1	9.10	7	12.82	10.03
70 PASQUOTANK	1	3.25	8	5.33	4.82
71 PENDER	4	14.76	15	11.81	10.58
72 PERQUIMANS	1	9.06	8	15.23	14.76
73 PERSON	3	9.54	13	8.47	7.86
74 PITT	9	8.82	44	8.96	10.52
75 POLK	1	6.79	4	5.50	6.20
76 RANDOLPH	9	8.75	38	7.66	9.57
77 RICHMOND	9	19.62	34	14.88	13.76
78 ROBESON	9	8.33	45	8.44	8.96
79 ROCKINGHAM	14	16.18	50	11.67	11.13
80 ROWAN	8	7.51	54	10.37	9.89
81 RUTHERFORD	3	5.18	27	9.44	9.30
82 SAMPSON	8	15.71	24	9.50	9.69
83 SCOTLAND	1	2.88	24	14.11	14.62
84 STANLY	2	3.91	20	7.94	8.04
85 STOKES	3	8.22	18	10.07	10.91
86 SURRY	8	12.88	34	11.08	13.67
87 SWAIN	3	28.52	11	20.67	19.98
88 TRANSYLVANIA	3	11.45	11	8.57	10.43
89 TYRRELL	3	73.26	5	24.32	18.04
90 UNION	5	5.95	23	5.74	6.74
91 VANCE	4	10.18	24	12.40	12.33
92 WAKE	30	7.72	124	6.80	8.06
93 WARREN	4	24.06	12	14.55	11.06
94 WASHINGTON	1	6.83	5	6.87	7.37
95 WATAUGA	0	0.00	7	4.07	13.93
96 WAYNE	12	12.16	53	10.78	10.33
97 WILKES	5	8.13	24	7.87	9.21
98 WILSON	8	12.19	41	12.64	11.79
99 YADKIN	4	13.19	16	10.77	15.54
100 YANCEY	1	6.24	6	7.60	5.79

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

CHRONIC LIVER DISEASE AND CIRRHOSIS

MORTALITY RATES PER 100,000 POPULATION

- 24.32 to 24.32
- 17.53 to 20.67
- 13.25 to 15.95
- 10.01 to 12.91
- 7.40 to 9.70
- 3.34 to 6.92

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
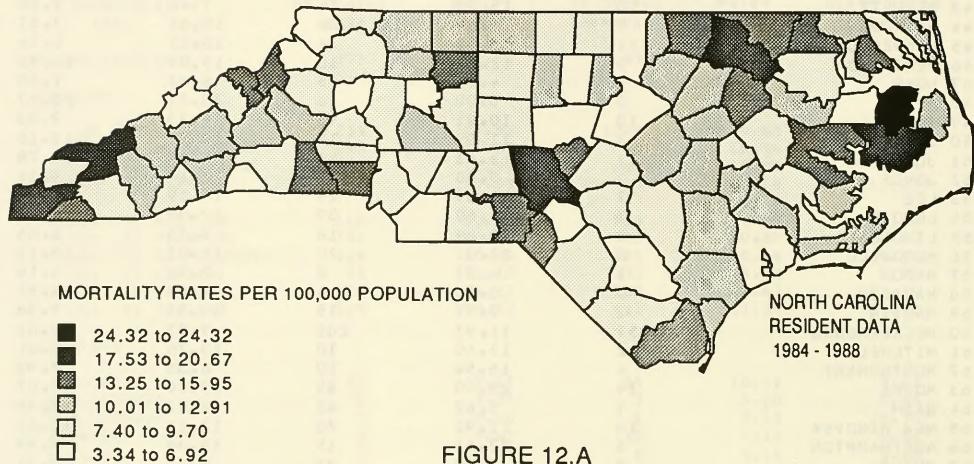
FIGURE 12.A

CHRONIC LIVER DISEASE AND CIRRHOSIS

AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 POPULATION

- 26.53 to 28.90
- 23.18 to 23.18
- 17.07 to 19.98
- 11.79 to 15.85
- 5.79 to 11.13
- 2.29 to 4.95

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
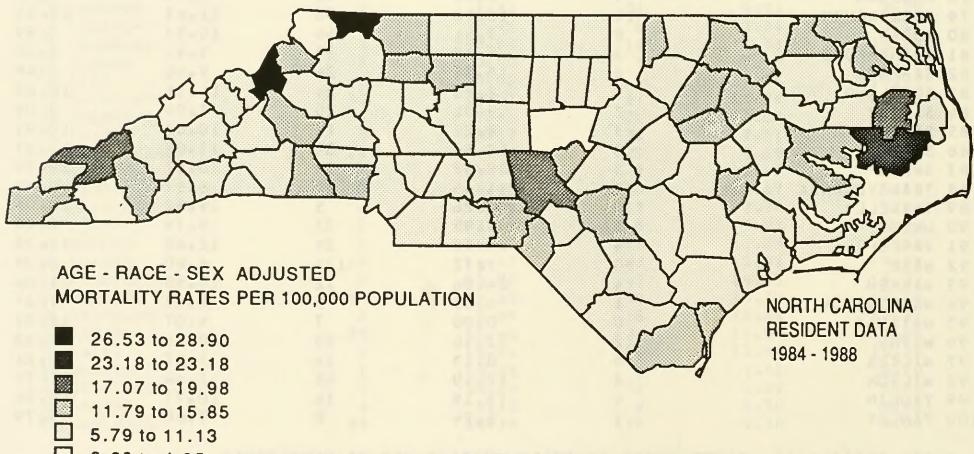
FIGURE 12.B

NEPHRITIS, NEPHROSIS AND NEPHROTIC SYNDROME

Nephritis, nephrotic syndrome, and nephrosis are diseases of the kidney. Nephritis is kidney failure, characterized by inflammation of the kidney, regardless of the causal agent (14). Nephrosis and nephrotic syndrome are synonymous for a condition in which excessive amounts of protein are excreted in the urine (15). Because the conditions are so closely related, they are lumped together for statistical purposes and will be referred to as nephritis/nephrosis in this section.

Four-hundred-sixty-nine North Carolinians died from nephritis/nephrosis in 1988. The nephritis/nephrosis death rate rose steadily during the early 1980's to peak at 9.9 deaths per 100,000 population in 1985. Since then, however, the rate has dropped substantially. The rate for nephritis/nephrosis in 1988, 7.2 deaths per 100,000 population, was the lowest since the change of ICD codes in 1979. Major changes in the coding classification make comparisons with years prior to 1979 problematic.

North Carolina's age-adjusted nephritis/nephrosis mortality rate compares favorably with the United State's rate, being nine percent lower (3).

Compared to 1979-83, race-sex-specific age-adjusted rates for 1984-88 show the following decreases: white males, 18 percent; white females, 6 percent; nonwhite males, 8 percent; and nonwhite females, 16 percent.

RISK FACTORS

Elderly persons are at higher risk of nephritis/nephrosis mortality than are younger persons. Nearly 80 percent of nephritis and nephrosis deaths were to persons age 65 and older in 1988. However, over 30 percent of nephritis/nephrosis deaths were specified as chronic, indicating a long-term health problem. Probably a larger percentage of deaths due to nephritis/nephrosis are chronic than is indicated on the death certificate.

Hypertension, heart disease and diabetes are conditions which are often associated with nephritis/nephrosis. When nephritis/nephrosis was listed as the underlying cause of death in 1988, 291 death certificates (62%) indicated that the decedent also had heart disease. When the underlying cause of death was heart disease, 887 certificates also listed nephritis/nephrosis as a significant condition present at death. Other causes of death with frequent mentions of nephritis/nephrosis were: cerebrovascular disease, 115; cancer, 416; diabetes, 210; pneumonia/influenza, 122. Nephritis/nephrosis was mentioned as a significant condition present at death on a total of 3,149 death certificates.

Because more people are bringing their hypertension under control, death rates from strokes and heart disease are declining. But the death rate for hypertension with renal disease is going up, suggesting that hypertension control drugs affect stroke and heart attack but not renal diseases (16).

GEOGRAPHIC PATTERNS

Due to the relatively low numbers of deaths for which nephritis was reported as the underlying cause in many counties, in addition to the substantially higher numbers of nephritis

mentions, the maps on nephritis use mentioned conditions rather than underlying cause data. These maps are presented in Section IX and show that any clustering was probably due to age-race-sex differences among the counties.

TABLE - 16

MORTALITY STATISTICS FOR 1988

NORTH CAROLINA RESIDENTS

NEPHRITIS AND NEPHROSIS

GEOGRAPHICAL AREA	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
NORTH CAROLINA	469	7.22	2641	8.34	8.34
REGIONS					
DHR I WESTERN	146	6.56	840	7.75	7.98
DHR II N. CENTRAL	94	6.89	548	8.21	7.92
DHR III S. CENTRAL	109	7.11	609	8.20	8.92
DHR IV EASTERN	120	8.77	644	9.59	8.68
HSA I WESTERN	66	6.20	419	7.77	7.68
HSA II PIEDMONT	75	6.24	452	7.68	7.76
HSA III S. PIEDMONT	78	6.91	421	7.73	8.28
HSA IV CAPITAL	71	7.32	398	8.59	8.76
HSA V CARDINAL	62	8.42	430	8.99	9.20
HSA VI EASTERN	95	8.48	521	9.45	8.50
COUNTIES					
1 ALAMANCE	11	10.38	54	10.43	9.12
2 ALEXANDER	0	0.00	4	2.97	4.66
3 ALLEGHANY	1	10.18	5	10.23	6.04
4 ANSON	6	22.86	14	10.67	8.96
5 ASHE	2	8.51	15	12.85	7.44
6 AVERY	1	6.55	6	7.95	6.99
7 BEAUFORT	3	7.07	24	11.34	8.48
8 BERTIE	4	19.01	18	16.98	14.83
9 BLADEN	5	16.16	22	14.27	12.62
10 BRUNSWICK	1	1.96	11	4.63	4.54
11 BUNCOMBE	9	5.19	53	6.24	4.59
12 BURKE	4	5.17	23	6.04	7.09
13 CABARRUS	5	5.21	29	6.20	6.43
14 CALDWELL	4	5.59	21	5.97	8.13
15 CAMDEN	0	0.00	3	10.15	8.36
16 CARTERET	3	5.87	16	6.49	7.56
17 CASWELL	1	4.50	9	8.09	7.35
18 CATAWBA	14	11.93	48	8.41	11.19
19 CHATHAM	3	8.16	21	11.70	9.90
20 CHEROKEE	0	0.00	6	5.84	3.26
21 CHOWAN	0	0.00	5	7.49	4.44
22 CLAY	1	13.74	2	5.59	3.19
23 CLEVELAND	6	6.88	34	7.90	7.71
24 COLUMBUS	11	20.92	47	17.96	15.09
25 CRAVEN	4	4.90	30	7.51	9.58
26 CUMBERLAND	9	3.53	59	4.62	8.45
27 CURRITUCK	1	7.14	3	4.47	4.81
28 DARE	4	18.63	7	7.47	11.91 *
29 DAVIDSON	10	8.04	50	8.24	10.40
30 DAVIE	1	3.59	10	7.41	8.32
31 DUPLIN	10	24.00	37	17.78	13.26
32 DURHAM	14	8.16	85	10.27	9.57
33 EDGECOMBE	7	11.68	28	9.50	6.25
34 FORSYTH	12	4.50	100	7.66	7.35
35 FRANKLIN	4	11.28	18	10.64	7.00
36 GASTON	12	6.88	70	8.14	9.63
37 GATES	0	0.00	5	10.49	5.06
38 GRAHAM	2	28.50	5	14.01	10.12
39 GRANVILLE	3	7.69	21	11.18	7.27
40 GREENE	1	6.10	7	8.49	9.78
41 GUILFORD	14	4.15	110	6.66	6.69

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

COUNTIES (CONT'D)	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
42 HALIFAX	7	12.31	45	15.98	9.58
43 HARNETT	4	6.03	29	9.04	9.73
44 HAYWOOD	4	8.28	18	7.48	5.53
45 HENDERSON	1	1.44	31	9.26	6.21
46 HERTFORD	1	4.22	12	10.06	5.61
47 HOKE	2	8.34	9	7.78	6.45
48 HYDE	0	0.00	3	10.25	8.04
49 IREDELL	8	8.73	43	9.68	9.91
50 JACKSON	1	3.69	13	9.66	11.41
51 JOHNSTON	5	6.19	31	7.94	8.14
52 JONES	0	0.00	5	10.14	9.99
53 LEE	5	11.92	36	17.61	18.06
54 LENOIR	6	9.95	44	14.56	11.95
55 LINCOLN	2	4.11	16	6.89	10.01
56 MCDOWELL	4	11.00	17	9.37	8.41
57 MACON	1	4.27	9	7.78	3.78
58 MADISON	1	5.80	7	8.11	4.68
59 MARTIN	4	15.14	21	15.84	9.32
60 MECKLENBURG	28	5.88	167	7.35	8.24
61 MITCHELL	0	0.00	7	9.62	5.57
62 MONTGOMERY	2	8.27	16	13.36	11.65
63 MOORE	4	6.74	28	9.93	7.61
64 NASH	9	12.37	31	8.67	7.94
65 NEW HANOVER	9	7.66	51	8.93	9.20
66 NORTHAMPTON	2	9.04	15	13.38	9.76
67 ONSLOW	3	2.39	25	4.04	9.31
68 ORANGE	5	5.65	22	5.20	6.42
69 PAMLICO	1	9.10	2	3.66	3.71
70 PASQUOTANK	2	6.51	13	8.66	6.86
71 PENDER	4	14.76	14	11.03	8.02
72 PERQUIMANS	0	0.00	9	17.14	9.23
73 PERSON	6	19.09	17	11.08	9.75
74 PITT	7	6.86	37	7.53	7.11
75 POLK	3	20.37	10	13.75	8.48
76 RANDOLPH	10	9.73	38	7.66	11.10
77 RICHMOND	7	15.26	33	14.45	13.05
78 ROBESON	13	12.03	59	11.06	9.17
79 ROCKINGHAM	6	6.93	33	7.70	7.43
80 ROWAN	10	9.73	46	8.83	7.21
81 RUTHERFORD	3	5.18	23	8.04	7.27
82 SAMPSON	5	9.82	24	9.50	7.86
83 SCOTLAND	0	0.00	14	8.23	11.44
84 STANLY	4	7.83	22	8.73	8.24
85 STOKES	1	2.74	6	3.35	4.55
86 SURRY	8	12.88	32	10.43	8.19
87 SWAIN	1	9.50	11	20.67	14.92
88 TRANSYLVANIA	0	0.00	9	7.01	11.31
89 TYRRELL	1	24.42	1	4.86	2.22
90 UNION	9	10.71	28	6.99	7.79
91 VANCE	2	5.09	19	9.82	8.45
92 WAKE	20	5.14	107	5.87	8.02
93 WARREN	4	24.06	21	25.47	13.45
94 WASHINGTON	2	13.66	13	17.86	13.40
95 WATAUGA	0	0.00	8	4.66	9.61
96 WAYNE	9	9.12	40	8.14	7.54
97 WILKES	4	6.51	31	10.17	10.74
98 WILSON	4	6.09	22	6.78	7.21
99 YADKIN	1	3.29	10	6.73	4.81
100 YANCEY	1	6.24	3	3.80	2.70

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

REFERENCES FOR SECTION VI

1. Boyd, Robert F., Ph.D., and Hoerl, Bryan G., Ph.D., _Basic Medical Biology_. Third Edition. Little, Brown and Company, Boston, 1986.

2. Braude, Abraham I., M.D., Ph.D., _Medical Microbiology and Infectious Diseases_. W.B. Saunders Company, Philadelphia, 1985.

3. United States Department of Health and Human Services. Public Health Service, Centers for Disease Control, National Center for Health Statistics. _Vital Statistics of the United States. 1987; Mortality Volume II. Part A_. Hyattsville, MD, 1989.

4. Tuomilehto, J. "Primary Prevention of Diabetes Mellitus," _Diabetes Care_. Volume 10, Number 2, March-April 1987.

5. Santiogo, J.V., "Overview of the Complications of Diabetes," _Clinical Chemistry_. Volume 32, Number 10, October 1986.

6. Centers for Disease Control. "Chronic Diseases Reports: Deaths from Diabetes - United States 1986," _MMWR_. Volume 38, Number 31, 1989, pp 543-46.

7. N.C. Office of State Budget and Management, State Data Center. "Older Adults: 1980 Census," _State Data Center Newsletter_. Vol. 10, No. 3, December 1988, p.8.

8. Patrick, K.M.; Wolley, F.R. "A Cost-Benefit Analysis of Immunization for Pneumococcal Pneumonia," Journal of the American Medical Association. Vol. 245, No. 5, February 1981, pp. 473-477.

9. Dennehy, Penelope H. "Respiratory Infections in the New-born," Clinics in Perinatology. Vol. 14, No. 3, September 1987, pp. 667-682.

10. North Carolina Department of Human Resources, Division of Health Services, State Center for Health Statistics. Leading Causes of Mortality, North Carolina Vital Statistics 1981 -- Volume 2. September 1983.

11. Centers for Disease Control. "Chronic Disease Reports: Chronic Obstructive Pulmonary Disease Mortality -- United States, 1986," Morbidity and Mortality Weekly Report. Vol. 38, No. 32, August 1989.

12. Anthonisen, Nicholas R. "Chronic Obstructive Pulmonary Disease," Canadian Medical Association Journal. Vol. 138, March 1988.

13. Hopkins DD, Grant-Worley JA, Bollinger TL. "Survey of Cause-of-Death Query Criteria Used by State Vital Statistics Programs in the US and the Efficacy of the Criteria Used by The Oregon Vital Statistics Program," American Journal of Public Health 1989; 79:570-574.

14. Klahr, Saulo. M.D. The Kidney and Body Fluids in Health and Disease. Plenum Medical Book Company, New York, 1983.

15. Mandal, Anin K., M.D. and Jennette, J. Charles, M.D. <u>Diagnosis and Management of Renal Disease and Hypertension</u>. Lea and Febiger, Philadelphia, 1988.

16. White, Marian S. <u>Renal Disease Prevention Project: Draft for Discussion Only</u>. Department of Environment, Health, and Natural Resources. Division of Adult Health. In progress.

VII. MAJOR EXTERNAL CAUSES OF MORTALITY

INJURIES

Injury is a major public health problem facing North Carolina in the decade of the nineties and beyond. Each year over 4,000 North Carolinians die from injuries. After heart disease, cancer, and stroke, injury ranks as the fourth leading cause of death in both the nation and the state. Injuries result in a larger death toll to children over the age of one than the total of the next six causes of mortality to that age group (1).

In this edition of Leading Causes of Mortality, the term "injuries" replaces "accidents" in the narrative portions. This usage is consistent with recommendations of the Governor's Task Force on Injury Prevention and Control. The connotation of "accidents" as random events beyond reasonable human control is considered an impediment to the prevention of injuries in North Carolina. Injuries are caused; therefore they can be prevented. The term "accidents" is used in the maps and tables to maintain continuity with nomenclature of the National Center for Health Statistics.

In contrast to the classification of diseases, injuries are categorized by the events or behaviors that preceded them and the imputed intent of those involved (1). By ICD codes, injury deaths (E800-E999) are routinely classified as unintentional (E800-E949) and intentional (E950-E978) with the unintentional category further subdivided into motor vehicle (E810-E825) and all other unintentional injury deaths (E800-E807, E826-E949). Intentional deaths are subdivided into homicide and legal

intervention (E960-E978) and suicide (E950-E959). The remaining injury deaths (not presented by table or map) include those deaths for which intent cannot be determined (E980-E989) or deaths resulting from operations of war (E990-E999). In 1988 there were 25 deaths of these types (E980-E999).

In 1988 there were 4,601 total injury deaths of North Carolina residents that occurred in the state, representing a rate of 70.9 deaths per 100,000 population. Of these deaths, 70 percent were classed as unintentional and 30 percent as intentional. Motor vehicle crashes resulted in 1,598 deaths, the single largest category of injury deaths, with other unintentional causes resulting in 1,616 deaths. Suicide exceeded homicide with 784 North Carolinians taking their own lives and 578 dying at the hands of others.

Injuries have been labeled the "last remaining plague of the young" with more Americans aged 1-34 dying from injuries than from all other categories combined (2). Injury is the leading cause of death in the 1-44 age group. As a result, for the total population, years of potential life lost from injuries exceeds that of either cancer or heart disease. In 1988, a total of 140,842 years of potential life were lost by N.C. residents who died of injuries.

The economic cost of injury fatalities in North Carolina in 1988 is estimated to have been almost 1.5 billion dollars. This is based upon national estimates of medical cost and lost wages due to premature death (3). Some variation in the magnitude of the amount may result from different medical care costs and wage levels between the state and the nation.

UNINTENDED MOTOR VEHICLE INJURIES

Motor vehicle deaths accounted for 35 percent of total injury deaths (1,598 of 4,601) and 50 percent of the unintended injury deaths in the state in 1988. The death rate for unintended motor vehicle injuries was 24.6 per 100,000 population. The North Carolina age-adjusted unintended motor vehicle mortality rate for 1987 was 23 percent greater than the United States rate (4).

With the exception of 1986, motor vehicle death rates in the state have remained stable over the 1984-1988 period. Between 1985 and 1986 the death rate for motor vehicle injuries jumped by 11 percent from 24.2 to 26.9 per 100,000 population. A corresponding decrease of 8.5 percent between 1986 and 1987 resulted in a convergence of the rate to near its 1985 level.

The age pattern of mortality from motor vehicle injuries in 1988 was characterized by a substantially higher rate in the 15-24 year age group than in other age categories. The unintended motor vehicle injury rate of 41.4 in the 15-24 year age group was 39 percent higher than the next highest age-specific rate (ages 25-34) and 49 percent higher than the rate for those 65 and older. Children between the ages of five and fourteen have the lowest risk of mortality from motor vehicle injuries.

An examination of race- and sex-specific rates indicates significantly higher unintended motor vehicle mortality in male

and nonwhite populations. Based upon age-adjusted rates for 1987, white males experienced a 149 percent higher mortality rate from motor vehicle injuries than did white females. The corresponding difference for nonwhite males was a 250 percent excess over the nonwhite female rate. The age-adjusted mortality rate for nonwhite males was 42 percent greater than the rate for white males while the age-adjusted rates for white and nonwhite females were nearly identical. (4)

Excess mortality among North Carolinians is apparent in an examination of race-sex-specific age-adjusted mortality in the state and the nation. White males and females in North Carolina experienced rates 15 percent higher than their national counter-parts. The rate for nonwhite males in the state was 67 percent higher than that for their national counterparts, and nonwhite females experienced a rate of unintended motor vehicle mortality 44 percent higher than that of nonwhite females in the United States.

Unlike diseases such as cancer or heart disease in which exposure to risks is often difficult to isolate, motor vehicle mortality is closely linked to use of automobiles, trucks, and motorcycles. While risk of death can be the result of walking along roadsides or riding a bicycle, the majority (84%) of motor vehicle deaths in North Carolina occur to drivers or passengers of motor vehicles on public roads. The Planning and Research Branch of the North Carolina Division of Highways publishes an annual estimate of the number of miles traveled based upon gasoline tax revenue. The mileage death rate for North Carolina in 1988 was 2.75 deaths per 100 million miles driven. This was down by 6.1 percent from 1987. The number of estimated miles traveled increased by 5.8 percent in the one-year period. (5)

RISK FACTORS

Alcohol was a major contributing factor to motor vehicle fatalities in North Carolina in 1988. Based on state Medical Examiner's* data, 56 percent of drivers in single vehicle crashes were legally intoxicated (.10 percent blood alcohol level), 19 percent of drivers of multiple vehicle crashes were intoxicated, and 41 percent of pedestrian victims were intoxicated. (6) A recent study of North Carolina crash data revealed that the drinking driver involved in a crash is at increased risk of serious injury or death relative to sober drivers (7).

A recent publication of the National Committee for Injury Prevention and Control states, "the connection is irrefutable; eliminating the mixture of alcohol consumption and automobiles would lead to dramatic decreases in death, injury, disability, and costs for all age groups" (8).

GEOGRAPHICAL PATTERNS

Figures 13.A and 13.B depict the county unadjusted and age-race-sex-adjusted rates for motor vehicle fatalities, while Table 17 presents numbers of deaths (as well as rates) for each county. The reader is cautioned that rates based on less than 20 events are generally unstable.

Figure 13.A shows that five of the nine counties in the two highest rate levels are in southcentral North Carolina. After adjustment for age, race, and sex (Figure 13.B), 13 of the 18 counties in the highest three levels are located in the eastern third of North Carolina.

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*Medical Examiner's data are based on resident and nonresident deaths for specified causes. The addition of nonresident deaths should have a nominal effect on percentages cited in the text.

Based on procedures described in Section II of this volume, there was significant clustering of counties with high mortality rates in southcentral North Carolina, as well as smaller groupings of high rate counties along the Virginia border. However, after adjustment for age, race, and sex, there was no significant clustering of high-rate counties. Similar findings observed during 1979-81 (9) suggest that clustering depicted in the map below is due largely to age, race, and/or sex composition of the county populations.

MOTOR VEHICLE ACCIDENTS

MORTALITY RATES PER 100,000 POPULATION

■ 33.44 to 54.57 (p<=.05)
■ 32.84 to 32.85 (p<=.05)
□ 12.28 to 32.75

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
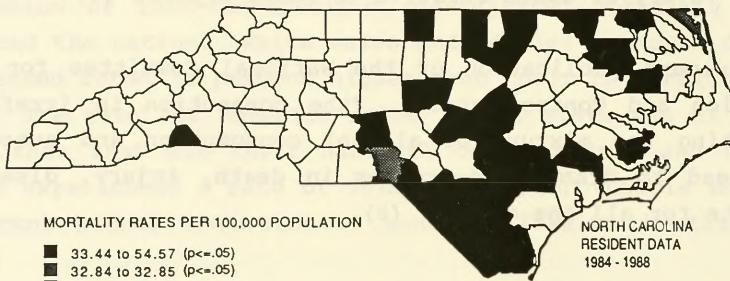
PREVENTION STRATEGIES

Efforts to reduce the states' death toll from motor vehicle injuries can be classified as legislation/enforcement, education/behavior change, and engineering/technology.

Interventions that are likely to be effective in reducing deaths include raising the state's alcohol excise tax, implementing educational programs to reduce drinking and driving among youths and young adults, and improving roadways by painting edge lines to discriminate between road and nonroad surfaces.

The use of safety belts has been shown to reduce morbidity and mortality in motor vehicle crashes. It is estimated that seat belts reduce fatalities 40 to 50 percent (10). Enhanced enforcement of safety belt use laws has been shown to be effective in increasing compliance (11).

7-8

M O R T A L I T Y S T A T I S T I C S F O R 1 9 8 8

N O R T H C A R O L I N A R E S I D E N T S

M O T O R V E H I C L E A C C I D E N T S

GEOGRAPHICAL AREA	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
NORTH CAROLINA	1598	24.63	7870	24.87	24.87
REGIONS					
DHR I WESTERN	520	23.38	2467	22.76	22.89
DHR II N. CENTRAL	352	25.81	1598	23.95	24.41
DHR III S. CENTRAL	381	24.85	1971	26.54	25.52
DHR IV EASTERN	345	25.22	1834	27.33	26.59
HSA I WESTERN	269	24.55	1276	23.66	23.80
HSA II PIEDMONT	284	23.63	1331	22.61	22.99
HSA III S. PIEDMONT	251	22.25	1191	21.87	22.34
HSA IV CAPITAL	225	23.20	1100	23.75	23.18
HSA V CARDINAL	286	29.39	1493	31.24	30.27
HSA VI EASTERN	283	25.27	1479	26.83	25.81
COUNTIES					
1 ALAMANCE	28	26.43	110	21.25	21.67
2 ALEXANDER	8	29.02	44	32.69	33.42
3 ALLEGHANY	2	20.36	6	12.28	10.55
4 ANSON	11	41.92	40	30.50	28.87
5 ASHE	10	42.57	24	20.56	16.68
6 AVERY	7	45.88	18	23.87	18.86
7 BEAUFORT	11	25.92	55	25.99	27.75
8 BERTIE	9	42.77	53	49.99	50.33
9 BLADEN	13	42.02	52	33.74	30.85
10 BRUNSWICK	15	29.43	84	35.37	37.38
11 BUNCOMBE	33	19.05	152	17.90	17.32
12 BURKE	20	25.86	91	23.93	23.23
13 CABARRUS	22	22.93	116	24.81	25.75
14 CALDWELL	19	26.59	86	24.46	24.88
15 CAMDEN	0	0.00	8	27.08	26.87
16 CARTERET	10	19.59	58	23.54	26.04
17 CASWELL	7	31.54	42	37.76	34.42
18 CATAWBA	30	25.56	156	27.34	27.99
19 CHATHAM	9	24.49	60	33.43	33.26
20 CHEROKEE	4	18.88	22	21.43	28.36
21 CHOWAN	3	21.90	19	28.47	32.52
22 CLAY	0	0.00	9	25.17	20.51
23 CLEVELAND	16	18.36	91	21.15	21.48
24 COLUMBUS	23	43.75	116	44.34	45.03
25 CRAVEN	17	20.83	91	22.78	22.21
26 CUMBERLAND	51	20.03	339	26.60	25.25
27 CURRITUCK	5	35.74	22	32.85	36.41
28 DARE	3	13.97	22	23.49	25.26
29 DAVIDSON	19	15.28	158	26.04	27.11
30 DAVIE	8	28.72	42	31.16	34.35
31 DUPLIN	13	31.21	72	34.60	36.30
32 DURHAM	26	15.16	132	15.95	15.19
33 EDGECOMBE	13	21.70	72	24.44	25.44
34 FORSYTH	38	14.26	199	15.25	15.81
35 FRANKLIN	14	39.49	59	34.88	34.56
36 GASTON	45	25.83	205	23.85	24.64
37 GATES	5	51.07	26	54.57	49.65
38 GRAHAM	1	14.25	8	22.43	49.11
39 GRANVILLE	19	48.74	69	36.76	38.77
40 GREENE	4	24.41	26	31.54	28.94
41 GUILFORD	77	22.85	337	20.40	20.86

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

COUNTIES (CONT'D)	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
42 HALIFAX	17	29.90	73	25.93	21.83
43 HARNETT	27	40.73	109	34.01	34.19
44 HAYWOOD	17	35.21	63	26.21	27.50
45 HENDERSON	18	25.98	84	25.09	24.19
46 HERTFORD	4	16.89	39	32.70	20.26
47 HOKE	6	25.02	24	20.75	17.30
48 HYDE	0	0.00	9	30.77	30.08
49 IREDELL	32	34.93	132	29.74	30.98
50 JACKSON	4	14.78	20	14.87	15.94
51 JOHNSTON	21	26.03	152	38.96	40.16
52 JONES	5	50.77	18	36.50	38.97
53 LEE	12	28.61	63	30.83	31.65
54 LENOIR	15	24.87	83	27.47	30.38
55 LINCOLN	18	37.04	76	32.74	34.84
56 MCDOWELL	16	44.02	49	27.01	29.51
57 MACON	7	29.90	21	18.17	50.25
58 MADISON	4	23.21	22	25.51	20.16
59 MARTIN	10	37.85	34	25.65	23.20
60 MECKLENBURG	75	15.75	378	16.65	17.10
61 MITCHELL	2	13.60	21	28.88	21.64
62 MONTGOMERY	10	41.37	41	34.24	35.81
63 MOORE	12	20.23	92	32.62	34.81
64 NASH	24	32.99	106	29.67	30.40
65 NEW HANOVER	13	11.07	115	20.14	20.23
66 NORTHAMPTON	12	54.27	38	33.91	25.86
67 ONSLOW	25	19.91	147	23.76	22.66
68 ORANGE	14	15.82	85	20.11	19.99
69 PAMLICO	3	27.32	19	34.80	38.82
70 PASQUOTANK	7	22.81	31	20.67	20.82
71 PENDER	11	40.61	40	31.51	29.56
72 PERQUIMANS	4	36.25	15	28.56	32.37
73 PERSON	13	41.37	45	29.34	29.15
74 PITT	25	24.50	102	20.77	19.92
75 POLK	7	47.54	26	35.75	36.71
76 RANDOLPH	44	42.82	150	30.23	31.78
77 RICHMOND	16	34.88	75	32.84	33.67
78 ROBESON	41	37.95	204	38.27	28.10
79 ROCKINGHAM	24	27.75	136	31.75	32.21
80 ROWAN	16	15.02	125	24.00	23.83
81 RUTHERFORD	14	24.21	89	31.14	31.10
82 SAMPSON	22	43.22	95	37.61	38.03
83 SCOTLAND	15	43.22	67	39.40	43.64
84 STANLY	17	33.30	53	21.05	21.09
85 STOKES	6	16.44	45	25.18	30.00
86 SURRY	24	38.64	74	24.13	22.10
87 SWAIN	1	9.50	14	26.30	28.43
88 TRANSYLVANIA	3	11.45	31	24.15	22.88
89 TYRRELL	0	0.00	3	14.59	21.34
90 UNION	26	30.94	106	26.47	27.95
91 VANCE	15	38.19	62	32.05	34.16
92 WAKE	75	19.30	341	18.72	18.79
93 WARREN	7	42.10	32	38.81	45.51
94 WASHINGTON	1	6.83	26	35.73	40.68
95 WATAUGA	6	17.30	30	17.48	13.43
96 WAYNE	24	24.33	115	23.41	23.85
97 WILKES	18	29.30	82	26.92	32.33
98 WILSON	14	21.34	97	29.90	29.57
99 YADKIN	9	29.68	38	25.58	29.82
100 YANCEY	2	12.49	17	21.55	17.05

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

MOTOR VEHICLE ACCIDENTS

MORTALITY RATES PER 100,000 POPULATION

- ■ 50.00 to 54.57
- ■ 37.61 to 44.34
- ▨ 28.47 to 36.76
- ▨ 22.43 to 27.47
- □ 14.59 to 21.55
- □ 12.28 to 12.28

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
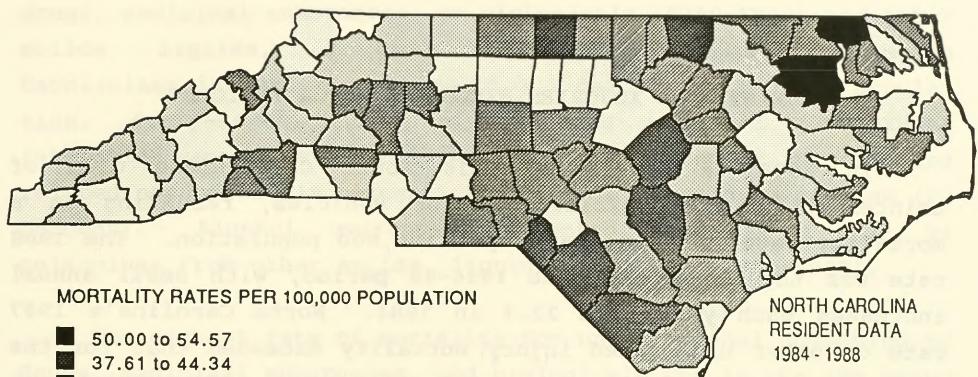
FIGURE 13.A

MOTOR VEHICLE ACCIDENTS

AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 POPULATION

- ■ 49.11 to 50.34
- ■ 43.65 to 45.51
- ▨ 35.81 to 40.68
- ▨ 26.88 to 34.84
- □ 18.79 to 26.04
- □ 10.56 to 17.32

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
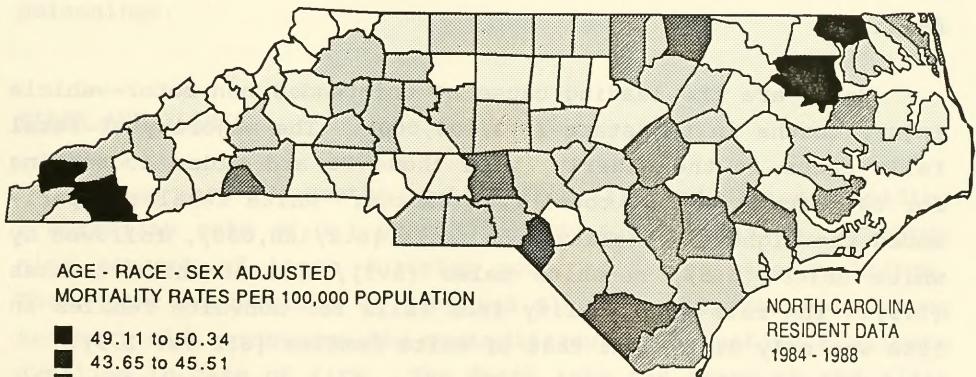
FIGURE 13.B

UNINTENDED INJURIES EXCLUDING MOTOR VEHICLES

In 1988, a total of 1,616 North Carolinians died of unintended injuries excluding motor vehicles, resulting in a mortality rate of 24.9 deaths per 100,000 population. The 1988 rate was the highest of the 1984-88 period, with small annual increases each year from 22.7 in 1984. North Carolina's 1987 rate of other unintended injury mortality exceeded that for the nation by 25 percent, after controlling for differential age structures in the two populations (4).

The major categories of unintended non-motor-vehicle mortality in the state and the nation are falls (E880-E888), poisonings (E850-E869), fires and flames (E890-E899), and drownings (E910). Because of the diverse etiologies of each of these types of injury, separate synopses are presented below.

FALLS

Falls are the leading cause of unintended non-motor-vehicle injury deaths in the state (5.3/100,000). The majority of fatal falls occur in the elderly, with those 75 and older accounting for 64 percent of the total fall deaths. White females experienced the highest mortality from falls (6.2/100,000), followed by white males (5.5), nonwhite males (5.2), and nonwhite females (1.9). The rate of mortality from falls for nonwhite females in 1988 was only 31 percent that of white females (6.2 vs. 1.9).

Fall mortality increased nine percent between 1986 and 1987, followed by a 13 percent increase between 1987 and 1988.

POISONINGS

Poisoning resulting from the ingestion or inhalation of drugs, medicinal substances, or biologicals (E850-E858) and other solids, liquids, or gases (E860-E869) killed 212 North Carolinians in 1988 for a rate of 3.3 deaths per 100,000 population. Forty-seven percent of the drug poisoning (E850-E858) fatalities were due to unintentional overdoses of opiates and related narcotics (18 percent) and stimulants such as cocaine (29 percent). Alcohol overdoses accounted for 71 of the 94 poisonings from other solids, liquids, or gases (E860-E869).

The highest rate of mortality for unintentional poisoning by drugs, medicinal substances, and biologicals was in the age group 25-34 (4.0 deaths per 100,000). Those aged 35-44 experienced the next highest mortality from this cause. Nonwhite males were much more likely than other race-sex groups to die of drug overdoses.

Unintended poisoning by other solids, liquids, or gases resulted in the deaths of 94 residents in 1988. The 45-54 age group experienced the highest rate of mortality from this cause. Nonwhite males had disproportionately more deaths from nondrug poisonings.

FIRES AND FLAMES

There were 201 deaths in 1988 from fire and flames, yielding a mortality rate of 3.1 deaths per 100,000 population. Eighty-nine percent of those injuries occurred in private dwellings. Those most susceptible to fire and flame deaths, the very young and very old, encounter the most difficulty evacuating a private dwelling in case of fire. The death rate for those 65 and older was 6.0 and for children less than 5 years old, 7.9 per 100,000. Nonwhite males had the highest race-sex specific rate of death

from fire and flames (9.3 per 100,000) followed by nonwhite females (3.6 per 100,000).

A majority of the fire and flame deaths in the state were not a direct result of the flames through burning, but of succumbing to consequences of the flames--smoke and carbon monoxide. At least seventy-three percent of those dying of fire and flames actually died from the inhalation of smoke and fumes from fires in private dwellings.

Most housefire deaths are the result of heating sources (32.8 percent) or smoking (25.7 percent) (12). As with many other types of injuries, alcohol plays a major role in housefire mortality. Based upon 1988 Medical Examiner's data, 41 percent of the fire and flame decedents tested for alcohol were legally intoxicated.

DROWNING

A total of 154 residents of the state died by unintentional drowning in 1988 yielding an annual rate of 2.4 deaths per 100,000 population. Persons aged 15-19 experienced the highest age-specific mortality rate (4.1 per 100,000) followed by infants and children less than five years old (3.5 per 100,000). The sex ratio of drowning decedents is the most unbalanced of the rates presented thus far with the male drowning rate (4.2 per 100,000 males) six times the female rate (0.7 per 100,000 females). Nonwhite males experienced a drowning rate (7.5 per 100,000 nonwhite males) 2.4 times that of their white counterparts (3.1 per 100,000 white males).

Of the drowning victims tested for alcohol in the Medical Examiner's system, 34 percent were found to have been legally intoxicated.

GEOGRAPHIC PATTERNS

There are no discernible geographical patterns of unintended nonmotor vehicle injury deaths by county (Fig. 14.A and Fig. 14.B). However, counties in the two highest rate levels in both figures are rural, and age-adjusted rates for the Cardinal, Eastern, and Western HSA regions (which are primarily rural) are noticeably higher than for the remaining HSA regions.

PREVENTION STRATEGIES

A number of prevention strategies have been recommended by the Governor's Task Force on Injuries. Strategies for specific injury causes are listed below:

INJURY   **INTERVENTION STRATEGIES**

DROWNINGS: Mandate that all outdoor swimming pools be covered
                 or fenced on four sides and secured with self-
                 locking gates; establish swimming areas that are
                 off limits to motorized watercraft; strictly
                 enforce laws that prohibit operating watercraft
                 while impaired; and teaching swimming and water
                 safety to school-age children and to adults.

POISONINGS: Ensure that toll-free telephone numbers for poison
                 control centers are available   throughout the
                 state; ensure that all households with children
                 are provided with poison control kits that include
                 syrup of ipecac with clear instructions for its
                 use; cabinet safety locks with reminders to store
                 poisons safely; and telephone stickers printed
                 with poison control center telephone numbers.

7-15

FALLS: Strengthen building codes to improve the safety of
                    steps, stairs, curbs, railings, and flooring;
                    ensure that institutions providing residential
                    care have staff that are adequately trained in
                    fall prevention; enforce Occupational Safety and
                    Health Administration standards for safety
                    harnesses in construction and other appropriate
                    occupational settings.

FIRE/FLAMES: Install and maintain smoke detectors and fire
                    extinguishers in all dwellings; adhere to product
                    safety standards for space heaters, woodstoves,
                    and non-flammable upholstery; promote the develop-
                    ment and sale of self-extinguishing cigarettes.
                    (14)

M O R T A L I T Y   S T A T I S T I C S   F O R   1 9 8 8

N O R T H   C A R O L I N A   R E S I D E N T S

A L L   O T H E R   A C C I D E N T S   A N D   A D V E R S E   E F F E C T S

GEOGRAPHICAL AREA	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
NORTH CAROLINA	1616	24.90	7464	23.58	23.58
REGIONS					
DHR I WESTERN	549	24.69	2488	22.95	23.16
DHR II N. CENTRAL	316	23.17	1514	22.69	22.30
DHR III S. CENTRAL	365	23.81	1721	23.17	23.87
DHR IV EASTERN	386	28.22	1741	25.95	24.76
HSA I WESTERN	290	26.45	1309	24.27	23.80
HSA II PIEDMONT	267	22.22	1281	21.76	21.78
HSA III S. PIEDMONT	259	22.96	1179	21.65	22.38
HSA IV CAPITAL	202	20.83	1006	21.72	22.14
HSA V CARDINAL	275	28.26	1236	25.86	25.80
HSA VI EASTERN	323	28.84	1453	26.36	24.86
COUNTIES					
1 ALAMANCE	34	32.10	117	22.60	22.03
2 ALEXANDER	5	18.14	25	18.57	19.68
3 ALLEGHANY	1	10.18	8	16.37	12.02
4 ANSON	16	60.97	57	43.46	35.49
5 ASHE	5	21.28	24	20.56	12.95
6 AVERY	5	32.77	21	27.85	83.10 *
7 BEAUFORT	11	25.92	64	30.24	28.02
8 BERTIE	8	38.02	38	35.84	22.25
9 BLADEN	11	35.56	47	30.49	29.11
10 BRUNSWICK	15	29.43	55	23.16	23.24
11 BUNCOMBE	57	32.91	247	29.08	25.44
12 BURKE	19	24.57	92	24.19	28.26
13 CABARRUS	20	20.84	96	20.54	21.14
14 CALDWELL	10	13.99	60	17.06	19.04
15 CAMDEN	3	49.52	12	40.62	34.95
16 CARTERET	24	47.02	69	28.01	34.49
17 CASWELL	4	18.02	30	26.97	24.95
18 CATAWBA	23	19.59	122	21.38	23.39
19 CHATHAM	12	32.66	57	31.76	28.66
20 CHEROKEE	9	42.48	22	21.43	20.22
21 CHOWAN	6	43.81	19	28.47	26.00
22 CLAY	0	0.00	4	11.18	6.84
23 CLEVELAND	27	30.99	112	26.03	26.08
24 COLUMBUS	16	30.44	82	31.34	29.78
25 CRAVEN	18	22.06	67	16.77	18.62
26 CUMBERLAND	64	25.13	293	22.99	28.63
27 CURRITUCK	1	7.14	9	13.43	12.05
28 DARE	4	18.63	31	33.10	31.23
29 DAVIDSON	25	20.11	123	20.27	21.58
30 DAVIE	8	28.72	32	23.74	23.40
31 DUPLIN	22	52.81	66	31.72	26.92
32 DURHAM	37	21.57	204	24.66	23.47
33 EDGECOMBE	21	35.06	89	30.21	25.93
34 FORSYTH	64	24.02	304	23.30	22.73
35 FRANKLIN	14	39.49	50	29.56	24.80
36 GASTON	40	22.96	194	22.57	23.77
37 GATES	2	20.42	14	29.38	24.58
38 GRAHAM	3	42.75	16	44.86	50.05
39 GRANVILLE	7	17.96	49	26.10	23.98
40 GREENE	2	12.20	27	32.75	32.04
41 GUILFORD	78	23.15	358	21.67	21.16

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

COUNTIES (CONT'D)	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
42 HALIFAX	13	22.87	81	28.78	21.22
43 HARNETT	28	42.24	86	26.83	28.16
44 HAYWOOD	18	37.29	72	29.95	19.58
45 HENDERSON	21	30.32	78	23.30	22.13
46 HERTFORD	9	38.02	51	42.76	33.59
47 HOKE	1	4.17	21	18.15	21.17
48 HYDE	2	35.22	10	34.19	27.22
49 IREDELL	21	22.92	119	26.81	27.31
50 JACKSON	7	25.87	30	22.31	22.55
51 JOHNSTON	28	34.71	112	28.70	29.91
52 JONES	5	50.77	14	28.39	24.87
53 LEE	7	16.69	50	24.47	24.95
54 LENOIR	15	24.87	85	28.13	24.60
55 LINCOLN	15	30.87	58	24.99	27.48
56 MCDOWELL	10	27.51	42	23.15	20.66
57 MACON	12	51.27	33	28.56	17.14
58 MADISON	8	46.42	34	39.42	26.96
59 MARTIN	8	30.28	41	30.93	28.73
60 MECKLENBURG	105	22.05	430	18.94	19.57
61 MITCHELL	3	20.40	18	24.76	15.54
62 MONTGOMERY	4	16.54	33	27.55	25.03
63 MOORE	12	20.23	65	23.05	21.54
64 NASH	26	35.74	113	31.63	28.93
65 NEW HANOVER	26	22.14	117	20.49	21.49
66 NORTHAMPTON	8	36.18	28	24.99	15.65
67 ONSLOW	22	17.52	119	19.23	23.20
68 ORANGE	10	11.30	61	14.43	16.66
69 PAMLICO	7	63.75	27	49.46	45.70
70 PASQUOTANK	6	19.55	32	21.33	20.70
71 PENDER	6	22.15	34	26.79	24.59
72 PERQUIMANS	4	36.25	15	28.56	27.28
73 PERSON	6	19.09	32	20.86	19.27
74 PITT	29	28.42	123	25.05	26.33
75 POLK	6	40.75	21	28.88	17.87
76 RANDOLPH	19	18.49	87	17.53	17.00
77 RICHMOND	15	32.70	58	25.39	24.95
78 ROBESON	32	29.62	176	33.02	28.12
79 ROCKINGHAM	17	19.65	93	21.71	21.39
80 ROWAN	23	21.59	150	28.80	26.85
81 RUTHERFORD	16	27.67	68	23.79	22.66
82 SAMPSON	16	31.43	77	30.48	27.07
83 SCOTLAND	13	37.46	35	20.58	20.44
84 STANLY	14	27.42	59	23.43	23.03
85 STOKES	2	5.48	33	18.46	21.82
86 SURRY	9	14.49	60	19.56	18.08
87 SWAIN	2	19.01	26	48.85	46.53
88 TRANSYLVANIA	8	30.54	17	13.24	11.32
89 TYRRELL	1	24.42	6	29.18	27.09
90 UNION	21	24.99	73	18.23	21.33
91 VANCE	18	45.83	73	37.74	30.71
92 WAKE	59	15.18	289	15.87	19.11
93 WARREN	4	24.06	29	35.17	32.07
94 WASHINGTON	4	27.32	20	27.48	27.69
95 WATAUGA	8	23.07	32	18.64	15.29
96 WAYNE	24	24.33	107	21.78	20.83
97 WILKES	6	9.76	61	20.02	19.05
98 WILSON	18	27.44	76	23.43	22.11
99 YADKIN	7	23.08	44	29.62	28.80
100 YANCEY	1	6.24	24	30.43	44.00 *

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

ALL OTHER ACCIDENTS AND ADVERSE EFFECTS

MORTALITY RATES PER 100,000 POPULATION

- ■ 48.86 to 49.46
- ▨ 39.43 to 44.86
- ▩ 35.18 to 37.74
- ▢ 26.03 to 34.19
- □ 15.87 to 25.40
- □ 11.19 to 14.43

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
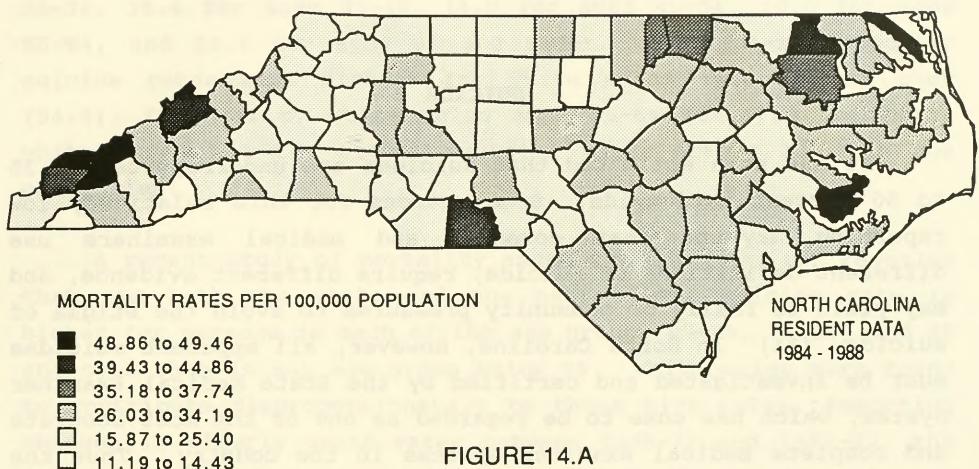
FIGURE 14.A

ALL OTHER ACCIDENTS AND ADVERSE EFFECTS

AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 POPULATION

- ■ 83.11 to 83.11
- ■ 44.01 to 50.05
- ▩ 33.59 to 35.49
- ▢ 18.63 to 32.07
- □ 11.33 to 18.08
- □ 6.48 to 6.48

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
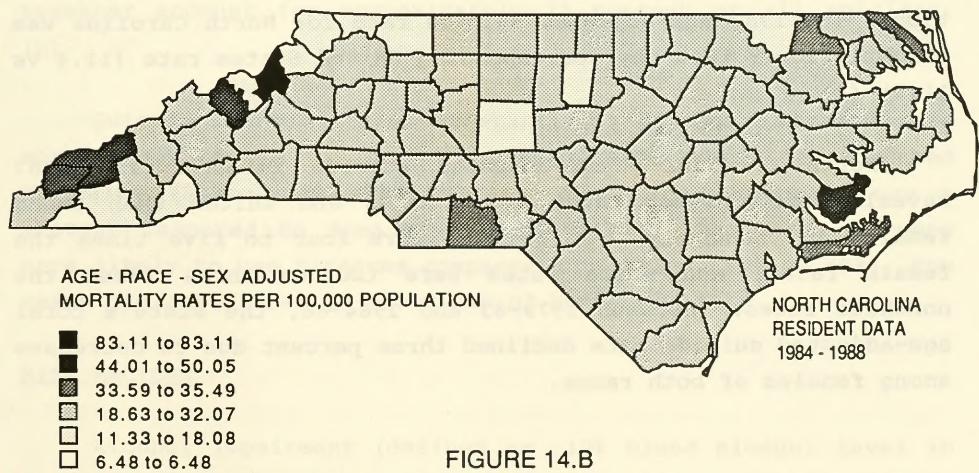
FIGURE 14.B

SUICIDE

It has been estimated that suicides are underreported by 25 to 50 percent nationwide. Some reasons for this relatively low reporting may be that coroners and medical examiners use different definitions of suicide, require different evidence, and may yield to family or community pressures to avoid the stigma of suicide. (11) In North Carolina, however, all apparent suicides must be investigated and certified by the State Medical Examiner System, which has come to be regarded as one of the most accurate and complete medical examiner systems in the country. Thus the reporting of suicide in North Carolina may be better than the national average.

Since 1972, North Carolina's suicide rate has remained fairly stable. Between 1984 and 1988, an average of 790 suicides per year resulted in a rate of 12.5 deaths per 100,000 population. The 1987 age-adjusted suicide rate for North Carolina was slightly lower than the corresponding United States rate (11.4 vs 11.7) (4).

North Carolina's age-adjusted suicide rates during 1987 revealed much higher rates among males and whites than among females and nonwhites. Male rates were four to five times the female rates, and white rates were two to three times the nonwhite rates. Between 1979-83 and 1984-88, the state's total age-adjusted suicide rate declined three percent due to decreases among females of both races.

Suicide rates are associated with age and they peak after age 64. The 1988 rates by age group were as follows: 0.0 for ages 0-4, 0.5 for ages 5-14, 8.6 for ages 15-24, 16.8 for ages 25-34, 15.4 for ages 35-44, 14.0 for ages 45-54, 16.0 for ages 55-64, and 21.7 for ages 65 and older. Age-race-sex specific suicide rates were highest for white males ages 65 and over (54.8), followed by white males ages 55-64 (34.1). In short, white males had the highest suicide rates across all the age categories.

A recent study of mortality among the elderly (15) revealed that, in both the state and the nation, the suicide rate is higher for persons in each of the age groups 65-74, 75-84, and 85 and over than in any age group below 65. White males were found to contribute disproportionately to those high rates. Reporting changes in elderly death rates between 1968-72 and 1983-87, the study also revealed substantial increases in the suicide rates of white females at ages 65-74 and 75-84.

Handguns were the most frequent means of suicide in 1988. Approximately 40 percent of the suicides were by handguns, followed by shotguns (20%), and rifles (11%). Firearm deaths together account for approximately 73 percent of all suicides. (6)

Suicide means differed substantially by sex. Females were more likely to use poisons (other than carbon monoxide) compared to males (31% vs 5%) while males were more likely to use a shotgun compared to females (24% vs 5%). Although males were more likely to use firearms compared to females (79% vs 49%), the sexes did not differ in their use of handguns. (6)

RISK FACTORS

Alcohol impairment (defined as .10% blood alcohol level in North Carolina DWI laws) was observed in 24 percent of suicide

victims in 1988. The percentages of impaired victims by race-sex groups were 28 percent for white males, 13 percent for white females, 21 percent for nonwhite males, and 20 percent for nonwhite females. For victims over the age of 14, persons ages 35-44 had the highest percentage of impaired victims (34%) while persons ages 65 and over had the lowest percentage of impaired victims (7%).

Research studies conducted outside of North Carolina have shown that suicide rates vary by marital status. Nonmarried persons at all ages have higher rates of suicide than married persons. Persons ages 65 and over who have recently lost their spouses have particularly high rates of suicide. (16,17)

Several case-control studies have shown that suicide victims had fewer visits from relatives, had fewer ties with their domestic and neighborhood groups, and lived alone more often compared with selected controls (18). Other risk factors identi-fied in the literature include previous suicide attempts, chronic pain, terminal illness, recent retirement, psychiatric disorders, and decline in social status (11, 16, 17, 18). Although depres-sion has been identified as being highly prevalent among suicide victims, it may be more important for suicide prevention purposes to identify the etiology of the depression.

Research studies of people who unsuccessfully attempt suicide (parasuicide victims) indicate that they are quite different from suicidal victims both demographically and in their chosen methods. Although the male suicide rate is much higher than the female rate, females attempt suicide approximately three times more often than males (11). Parasuicide victims also are younger than suicide victims (16, 17). Drug ingestion is the most common method among parasuicide victims while firearm injuries are relatively uncommon because of the high case-facili-ty rate from such injuries (1).

GEOGRAPHIC PATTERNS

The geographic patterns of unadjusted and age-race-sex-adjusted suicide rates are shown in Figures 15.A and 15.B respectively. Rates for counties with fewer than 20 suicides during the time period 1984-88 should be interpreted with caution. When counties with high suicide rates were tested for geographic clustering (see Section II), no statistically significant spatial clusters were found.

PREVENTION STRATEGIES

The prevention of suicide has mainly been within the purview of the mental health system. Interventions include establishing suicide prevention centers, identifying parasuicide victims and ensuring that they receive appropriate treatment, and implementing school-based programs that are designed to educate administrators, faculty, students, and parents about the warning signs of suicide and available resources for help. Although these interventions may perform a variety of important roles in society, they still must be evaluated for effectiveness in suicide and parasuicide prevention. (10)

Interventions that the literature indicates may be effective usually reduce the availability of the means of suicide. In North Carolina, these interventions would mostly involve gun control. Other interventions addressing the means of suicide include tighter prescription requirements for highly toxic psychotropic drugs, and devices that shut off a car's engine if dangerous levels of carbon monoxide build up inside the car. There is speculation that these interventions have the potential to be effective because if common and culturally acceptable means of suicide are eliminated, potential suicide victims may simply not choose an alternative method. (11)

MORTALITY STATISTICS FOR 1988

NORTH CAROLINA RESIDENTS

SUICIDE

GEOGRAPHICAL AREA	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
NORTH CAROLINA	784	12.08	3952	12.49	12.49
REGIONS					
OHR I WESTERN	319	14.34	1455	13.42	12.57
OHR II N. CENTRAL	162	11.88	880	13.19	12.92
OHR III S. CENTRAL	166	10.82	828	11.14	12.02
OHR IV EASTERN	137	10.01	789	11.76	12.80
HSA I WESTERN	177	16.15	791	14.67	13.59
HSA II PIEDMONT	147	12.23	786	13.35	12.86
HSA III S. PIEDMONT	142	12.58	664	12.19	11.91
HSA IV CAPITAL	103	10.62	515	11.12	11.60
HSA V CAROINAL	103	10.58	543	11.36	12.54
HSA VI EASTERN	112	10.00	653	11.84	13.15
COUNTIES					
1 ALAMANCE	12	11.33	75	14.49	13.93
2 ALEXANDER	6	21.76	24	17.83	21.70
3 ALLEGHANY	0	0.00	10	20.46	15.65
4 ANSON	8	30.48	24	18.30	25.75
5 ASHE	2	8.51	19	16.27	12.32
6 AVERY	1	6.55	3	3.97	3.25
7 BEAUFORT	9	21.21	30	14.17	15.10
8 BERTIE	0	0.00	12	11.32	11.24
9 BLADEN	6	19.39	18	11.68	12.88
10 BRUNSWICK	4	7.84	26	10.94	10.94
11 BUNCOMBE	22	12.70	129	15.19	14.25
12 BURKE	19	24.57	63	16.57	17.40
13 CABARRUS	10	10.42	53	11.33	11.04
14 CALDWELL	12	16.79	50	14.22	13.73
15 CAMDEN	1	16.50	5	16.92	18.14
16 CARTERET	8	15.67	31	12.58	10.75
17 CASWELL	1	4.50	9	8.09	8.98
18 CATAWBA	14	11.93	66	11.56	10.45
19 CHATHAM	8	21.77	25	13.93	13.72
20 CHEROKEE	3	14.16	18	17.53	12.00
21 CHOWAN	1	7.30	6	8.99	11.14
22 CLAY	1	13.74	5	13.98	9.89
23 CLEVELAND	7	8.03	48	11.15	11.08
24 COLUMBUS	1	1.90	25	9.55	10.39
25 CRAVEN	3	3.67	46	11.51	13.05
26 CUMBERLAND	20	7.85	133	10.43	12.06
27 CURRITUCK	3	21.44	16	23.89	21.76
28 DARE	1	4.65	17	18.15	13.83
29 DAVIDSON	16	12.87	76	12.53	11.49
30 DAVIE	2	7.18	19	14.09	12.79
31 DUPLIN	4	9.60	24	11.53	12.64
32 DURHAM	18	10.49	90	10.88	12.58
33 EDGECOMBE	4	6.67	31	10.52	14.04
34 FORSYTH	23	8.63	160	12.26	12.18
35 FRANKLIN	2	5.64	15	8.86	10.20
36 GASTON	24	13.77	94	10.93	10.10
37 GATES	1	10.21	4	8.39	11.22
38 GRAHAM	0	0.00	3	8.41	6.89
39 GRANVILLE	3	7.69	29	15.45	13.91
40 GREENE	1	6.10	10	12.13	14.83
41 GUILFORD	48	14.25	211	12.77	12.95

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

COUNTIES (CONT'D)	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
42 HALIFAX	6	10.55	27	9.59	11.47
43 HARNETT	9	13.57	44	13.73	14.51
44 HAYWOOD	12	24.86	36	14.97	11.19
45 HENDERSON	15	21.65	64	19.12	14.65
46 HERTFORD	1	4.22	10	8.38	7.92
47 HOKE	2	8.34	9	7.78	8.06
48 HYDE	3	52.84	7	23.93	23.66
49 IREDELL	15	16.37	62	13.96	13.73
50 JACKSON	4	14.78	20	14.87	15.16
51 JOHNSTON	18	22.31	65	16.66	15.98
52 JONES	1	10.15	6	12.16	10.08
53 LEE	3	7.15	26	12.72	12.96
54 LENOIR	7	11.60	40	13.23	15.88
55 LINCOLN	6	12.34	33	14.21	14.67
56 MCDOWELL	5	13.75	22	12.12	15.47
57 MACON	2	8.54	19	16.44	12.03
58 MADISON	2	11.60	11	12.75	10.15
59 MARTIN	4	15.14	17	12.82	15.47
60 MECKLENBURG	55	11.55	254	11.19	11.58
61 MITCHELL	4	27.21	14	19.25	13.12
62 MONTGOMERY	1	4.13	14	11.69	11.36
63 MOORE	8	13.48	43	15.24	13.33
64 NASH	3	4.12	38	10.63	12.14
65 NEW HANOVER	17	14.47	67	11.73	11.69
66 NORTHAMPTON	1	4.52	9	8.03	10.63
67 ONSLOW	13	10.35	53	8.56	10.49
68 ORANGE	11	12.43	49	11.59	12.20
69 PAMLICO	2	18.21	8	14.65	15.06
70 PASQUOTANK	4	13.00	11	7.33	7.52
71 PENDER	3	11.07	18	14.18	15.94
72 PERQUIMANS	4	36.25	10	19.04	19.99
73 PERSON	1	3.18	23	14.99	15.74
74 PITT	9	8.82	58	11.81	14.77
75 POLK	2	13.58	10	13.75	14.51
76 RANDOLPH	15	14.59	62	12.49	11.10
77 RICHMOND	5	10.90	16	7.00	7.42
78 ROBESON	10	9.25	51	9.56	11.63
79 ROCKINGHAM	12	13.87	74	17.27	17.01
80 ROWAN	16	15.02	79	15.17	13.96
81 RUTHERFORD	10	17.29	41	14.34	12.97
82 SAMPSON	9	17.68	35	13.85	15.17
83 SCOTLAND	0	0.00	20	11.76	13.95
84 STANLY	8	15.67	46	18.27	15.83
85 STOKES	6	16.44	22	12.31	11.83
86 SURRY	9	14.49	54	17.60	15.41
87 SWAIN	4	38.03	11	20.67	18.96
88 TRANSYLVANIA	6	22.91	23	17.92	14.08
89 TYRRELL	0	0.00	2	9.72	11.39
90 UNION	8	9.52	43	10.74	11.01
91 VANCE	6	15.27	18	9.30	11.63
92 WAKE	30	7.72	166	9.11	8.71
93 WARREN	3	18.04	9	10.91	17.56
94 WASHINGTON	2	13.66	6	8.24	9.46
95 WATAUGA	6	17.30	17	9.90	7.74
96 WAYNE	9	9.12	61	12.41	13.90
97 WILKES	17	27.67	56	18.38	18.65
98 WILSON	7	10.67	58	17.88	20.33
99 YADKIN	3	9.89	24	16.16	14.48
100 YANCEY	1	6.24	9	11.41	20.00

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

SUICIDE

MORTALITY RATES PER 100,000 POPULATION

- ■ 23.89 to 23.93
- ▨ 20.47 to 20.67
- ▨ 16.16 to 19.26
- ▨ 10.44 to 15.45
- □ 7.01 to 9.90
- □ 3.98 to 3.98

NORTH CAROLINA
RESIDENT DATA
1984 - 1988

FIGURE 15.A

SUICIDE

AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 POPULATION

- ■ 23.67 to 25.76
- ▨ 17.01 to 21.77
- ▨ 13.73 to 15.98
- ▨ 9.90 to 13.34
- □ 6.89 to 9.46
- □ 3.25 to 3.25

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
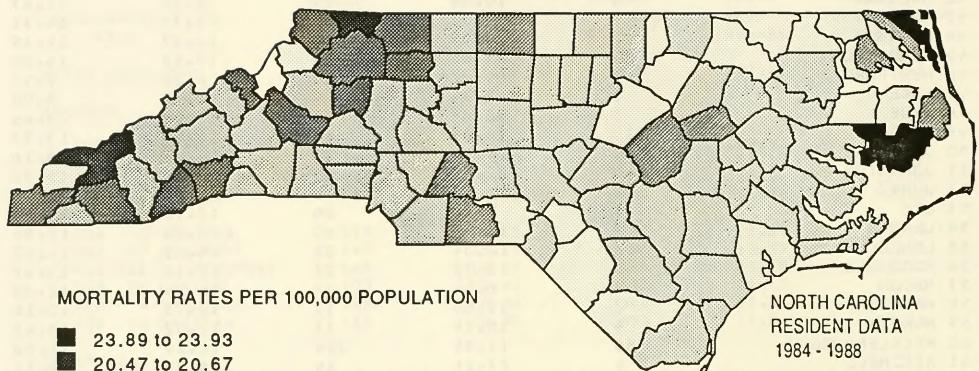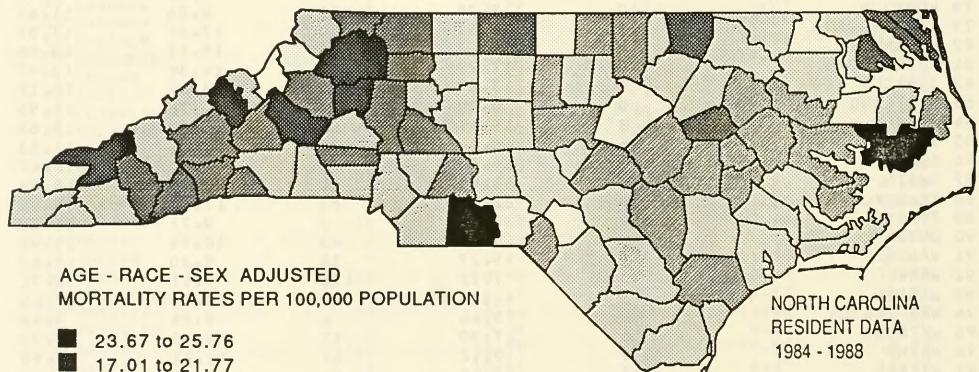
FIGURE 15.B

HOMICIDE

In the past, homicide was considered the concern of the criminal justice system which focused on the perpetrators and the definition of guilt. During the 1970's, however, public health professionals began to realize that homicide was not only a law enforcement problem, but a public health problem as well. In the 1980's, public health professionals complemented the criminal justice system's approach to homicide by focusing on the victims and on the risk factors associated with homicide.

Following a precipitous decline in the 1970's, North Carolina's homicide rate has remained fairly stable. Between 1984 and 1988, there was an average of 567 deaths per year for an approximate rate of 9.0 deaths per 100,000 population. The 1987 age-adjusted homicide rate for North Carolina was higher than the corresponding United States rate by a modest 3.5 percent (4).

In North Carolina, 1987 age-adjusted homicide rates were over three times as high for nonwhites as for whites. Rates for males were approximately three times the rates for females and nonwhite males were the race-sex group at greatest risk. Age-specific homicide rates reveal that persons ages 25-34 are the age group at greatest risk, followed by the 35-44 and 15-24 age groups. Nonwhite males ages 25-34 are the demographic group at greatest risk for homicide with a 1988 death rates of 64.1. They are followed by nonwhite males ages 35-44 with a rate of 54.7 and nonwhite males ages 45-54 with a rate of 37.4.

Handguns were the most frequent means of death in homicides, followed by sharp instruments and shotguns. Firearm deaths together accounted for approximately 64 percent of all homicides (6). Research studies outside of North Carolina have revealed that although many more people are assaulted with sharp instruments than with firearms, the ratio of deaths to injuries is approximately five times as great for shootings. This suggests that the primary basis for the high death rate from firearms may be the lethality of the weapons rather than the characteristics of the people who kill or are killed (1).

Approximately one-third of all homicides in North Carolina occur at or around the hour of midnight (10:00 PM - 1:59 AM). Homicides are more likely to occur on weekends and at private homes. (6)

RISK FACTORS

Alcohol involvement was a significant factor in 1988 homicides as 37 percent of the homicide victims were intoxicated (defined as .10 percent blood alcohol level). The percentage of intoxicated victims varied by race-sex group; 46 percent of nonwhite males, 39 percent of white males, 24 percent of nonwhite females, and 13 percent of white females were intoxicated. The age group with the largest percentage of intoxicated victims was persons ages 35-44 (49%), followed by persons ages 25-34 (42%) and 45-54 (39%). Homicides that involved sharp instruments had the largest percentage of intoxicated victims (48%) followed by shotgun homicides (41%) and blunt instrument homicides (38%).

An important descriptor of homicide is the victim-perpetrator relationship. In 1988, approximately 74 percent of the state's homicide victims knew their perpetrator (19). Other research studies have shown that a greater proportion of female homicide victims were killed by family members or intimate

acquaintances compared with male homicide victims. In fact, women were most likely to be killed by their husbands or ex-husbands. In contrast, men were most likely to be killed by acquaintances. Homicide victims and perpetrators are also usually of the same race. (19,20)

Another important descriptor is the circumstance surrounding the homicide. Over one-third of the state's 1988 homicides were precipitated by an argument (19). This proportion is probably understated because most of the other known circumstances are listed as domestic abuse. Other research studies have shown that the circumstance of the homicide varies with age and victim-perpetrator relationship. A greater proportion of homicides involving persons ages 60 and above are precipitated by a felony compared with the younger age groups (1). Furthermore, when the perpetrator is a stranger to the victim, the homicide is almost exclusively precipitated by a felony (20).

One significant risk factor associated with homicide that has not been studied in North Carolina is socioeconomic status. Several studies have shown that persons of low socioeconomic status are at an increased risk of homicide. In fact, when socioeconomic status is taken into consideration, racial differences in homicide rates become quite small (11). Socioeconomic status is also an important geographic variable because homicide rates are more than twice as high in low-income areas as in high-income areas (1).

GEOGRAPHIC PATTERNS

The geographic patterns of homicide rates and homicide age-race-sex-adjusted rates are shown in Figures 16.A and 16.B. Rates for the 45 counties with fewer than 20 homicides during the 1984-1988 period are likely to be unstable. When counties with high homicide rates were tested for geographic clustering, a

statistically significant spatial cluster was found (see map below). However, statistical significance disappeared after adjustment for age, race, and sex.

HOMICIDE

MORTALITY RATES PER 100,000 POPULATION

■ 10.66 to 17.54 (p<=.05)
☐ 0.86 to 10.50

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
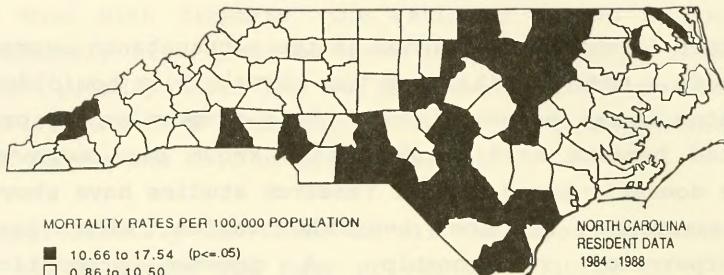
PREVENTION STRATEGIES

The prevention of homicide has usually been within the purview of the criminal justice system. Interventions include the enforcement of laws against homicide, imprisonment, mandatory sentences, and increased police patrols. Public health professionals, however, are becoming more active in homicide prevention. A series of interventions frequently mentioned in the literature address gun control. These interventions include restrictive licensing of firearms (restricting the possession of firearms to those with a clearly demonstrated need), permissive licensing of firearms with waiting periods and background checks, selective prohibition on the carrying of firearms, and restriction of the manufacture, sale, possession, and carrying of handguns. More research is needed, however, to evaluate the effectiveness of these gun control measures (1).

Other interventions regarding homicide prevention are mostly in the area of education and rehabilitation. These interventions include drug and alcohol prevention and rehabilitation programs,

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school-based curricula dealing with conflict resolution and violence prevention, and community-based programs for the prevention of domestic abuse (21). Whatever the intervention, health care providers, criminal justice agencies, schools, and social service agencies should communicate and cooperate to a greater extent to reduce North Carolina's homicide rate.

M O R T A L I T Y   S T A T I S T I C S   F O R   1 9 8 8

N O R T H   C A R O L I N A   R E S I D E N T S

H O M I C I D E

GEOGRAPHICAL AREA	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
NORTH CAROLINA	578	8.90	2834	8.95	8.95
REGIONS					
OHR 1 WESTERN	162	7.28	889	8.20	10.21
OHR II N. CENTRAL	115	8.43	570	8.54	8.73
OHR III S. CENTRAL	158	10.30	777	10.46	9.30
OHR IV EASTERN	143	10.45	598	8.91	8.06
HSA I WESTERN	64	5.84	366	6.78	9.42
HSA II PIEDMONT	101	8.40	483	8.20	8.81
HSA III S. PIEDMONT	98	8.68	523	9.60	10.35
HSA IV CAPITAL	75	7.73	426	9.19	8.37
HSA V CARDINAL	126	12.94	558	11.67	10.49
HSA VI EASTERN	114	10.18	478	8.67	7.69
COUNTIES					
1 ALAMANCE	10	9.44	39	7.53	8.26
2 ALEXANDER	0	0.00	3	2.22	1.75
3 ALLEGHANY	0	0.00	1	2.04	1.69
4 ANSON	10	38.11	23	17.53	17.19
5 ASHE	0	0.00	1	0.85	0.63
6 AVERY	0	0.00	1	1.32	14.80
7 BEAUFORT	5	11.78	21	9.92	10.26
8 BERTIE	1	4.75	6	7.54	7.63
9 BLADEN	5	16.16	18	11.68	8.78
10 BRUNSWICK	10	19.62	27	11.36	11.87
11 BUNCOMBE	9	5.19	61	7.18	9.71
12 BURKE	6	7.76	30	7.89	9.88
13 CABARRUS	9	9.38	33	7.06	10.28
14 CALDWELL	5	6.99	26	7.39	9.07
15 CAMDEN	3	49.52	4	13.54	13.07
16 CARTERET	3	5.87	10	4.05	5.03
17 CASWELL	1	4.50	6	5.39	3.99
18 CATAWBA	7	5.96	37	6.48	9.56
19 CHATHAM	2	5.44	25	13.93	12.84
20 CHEROKEE	0	0.00	5	4.87	4.57
21 CHOWAN	3	21.90	8	11.98	13.20
22 CLAY	0	0.00	1	2.79	2.41
23 CLEVELAND	13	14.92	47	10.92	12.08
24 COLUMBUS	7	13.31	26	9.93	8.59
25 CRAVEN	7	8.57	34	8.51	7.91
26 CUMBERLAND	30	11.78	151	11.84	10.91
27 CURRITUCK	2	14.29	5	7.46	10.19
28 DARE	0	0.00	3	3.20	4.38
29 DAVIDSON	13	10.45	47	7.74	10.70
30 DAVIE	5	17.95	7	5.19	6.59
31 DUPLIN	4	9.60	13	6.24	6.12
32 DURHAM	21	12.24	104	12.57	9.82
33 EDGECOMBE	5	8.34	37	12.55	9.30
34 FORSYTH	22	8.25	137	10.50	10.07
35 FRANKLIN	3	8.46	26	15.37	13.91
36 GASTON	21	12.05	78	9.07	11.70
37 GATES	0	0.00	5	10.49	7.01
38 GRAHAM	0	0.00	3	8.41	7.11
39 GRANVILLE	3	7.69	24	12.78	11.55
40 GREENE	4	24.41	6	7.27	6.21
41 GUILFORD	29	8.60	146	8.84	8.32

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

COUNTIES (CONT'D)	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
42 HALIFAX	8	14.07	30	10.65	7.87
43 HARNETT	7	10.56	35	10.92	11.42
44 HAYWOOD	1	2.07	11	4.57	7.78
45 HENDERSON	3	4.33	22	6.57	10.97
46 HERTFORD	1	4.22	12	10.06	6.72
47 HOKE	1	4.17	8	6.91	6.26
48 HYDE	0	0.00	2	6.83	8.45
49 IREDELL	7	7.64	43	9.68	10.97
50 JACKSON	0	0.00	6	4.46	6.26
51 JOHNSTON	8	9.91	40	10.25	11.82
52 JONES	2	20.31	3	6.08	8.47
53 LEE	2	4.76	17	8.32	8.82
54 LENOIR	5	8.29	29	9.59	8.08
55 LINCOLN	2	4.11	14	6.03	7.68
56 MCDOWELL	3	8.25	17	9.37	10.27
57 MACON	1	4.27	4	3.46	20.89
58 MADISON	0	0.00	8	9.27	7.50
59 MARTIN	3	11.35	11	8.29	7.05
60 MECKLENBURG	44	9.24	284	12.51	11.07
61 MITCHELL	0	0.00	4	5.50	3.91
62 MONTGOMERY	3	12.41	13	10.85	11.09
63 MOORE	5	8.42	21	7.44	8.39
64 NASH	15	20.62	39	10.91	10.28
65 NEW HANOVER	7	5.96	47	8.23	8.37
66 NORTHAMPTON	4	18.09	16	14.28	8.25
67 ONSLOW	5	3.98	32	5.17	5.64
68 ORANGE	8	9.04	32	7.57	7.59
69 PAMLICO	1	9.10	2	3.66	2.81
70 PASQUOTANK	4	13.03	11	7.33	6.05
71 PENDER	5	18.46	20	15.75	13.33
72 PERQUIMANS	0	0.00	1	1.90	1.71
73 PERSON	2	6.36	12	7.82	7.56
74 PITT	8	7.84	26	5.29	5.11
75 POLK	2	13.58	5	6.87	14.88
76 RANDOLPH	8	7.78	41	8.26	13.46
77 RICHMOND	8	17.44	30	13.13	13.26
78 ROBESON	20	18.51	91	17.07	12.93
79 ROCKINGHAM	10	11.56	31	7.23	7.73
80 ROWAN	3	2.81	35	6.72	7.75
81 RUTHERFORD	4	6.91	26	9.09	10.18
82 SAMPSON	3	5.89	21	8.31	7.78
83 SCOTLAND	5	14.40	27	15.87	12.63
84 STANLY	4	7.83	12	4.76	5.62
85 STOKES	0	0.00	11	6.15	7.55
86 SURRY	3	4.83	14	4.56	9.22
87 SWAIN	2	19.01	7	13.15	13.81
88 TRANSYLVANIA	1	3.81	6	4.67	4.06
89 TYRRELL	1	24.42	2	9.72	12.19
90 UNION	8	9.52	24	5.99	8.05
91 VANCE	5	12.73	23	11.89	9.39
92 WAKE	20	5.14	121	6.64	6.55
93 WARREN	1	6.01	2	2.42	0.80
94 WASHINGTON	0	0.00	5	6.87	4.75
95 WATAUGA	2	5.76	3	1.74	1.40
96 WAYNE	9	9.12	59	12.01	10.87
97 WILKES	5	8.13	28	9.19	11.13
98 WILSON	11	16.77	44	13.56	11.94
99 YADKIN	0	0.00	4	2.69	2.10
100 YANCEY	0	0.00	3	3.80	3.22

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

HOMICIDE

MORTALITY RATES PER 100,000 POPULATION

- ■ 15.37 to 17.54
- ■ 12.52 to 14.28
- ▨ 8.84 to 12.01
- ▨ 5.99 to 8.51
- □ 3.20 to 5.50
- □ 0.86 to 2.80

NORTH CAROLINA
RESIDENT DATA
1984 - 1988

FIGURE 16.A

HOMICIDE

AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 POPULATION

- ■ 20.89 to 20.89
- ■ 17.20 to 17.20
- ▨ 12.63 to 14.89
- ▨ 9.07 to 12.20
- □ 5.63 to 8.82
- □ 0.63 to 5.12

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
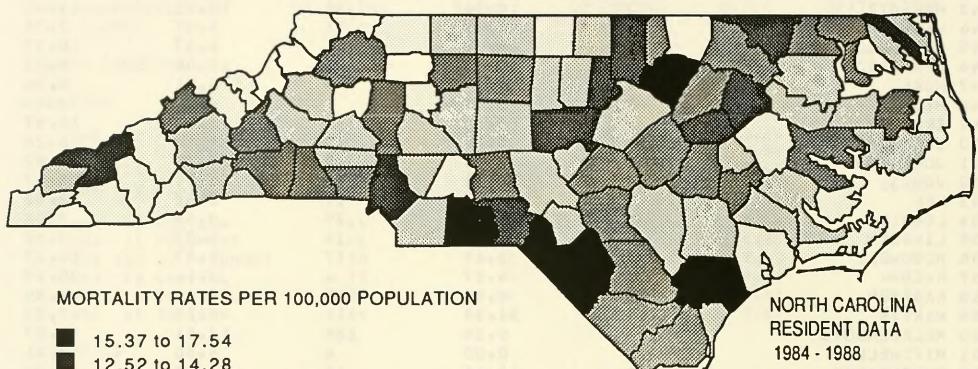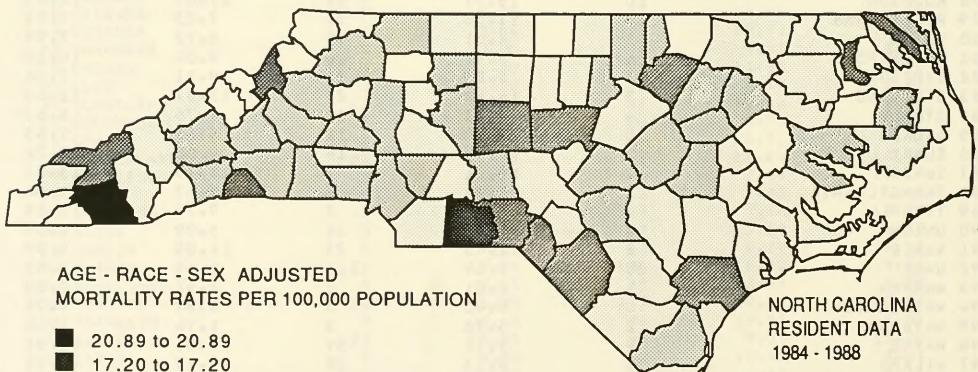
FIGURE 16.B

REFERENCES

1. Baker, S., O'Neill, B., Karpf, R. The Injury Fact Book. Lexington, Massachusetts: Lexington, 1984.

2. Institute of Medicine. Injury In America: A Continuing Public Health Problem.   Washington, D.C.: National Academy Press, 1985.

3. Rice, D.P., MacKenzie, E.J., and Associates. Cost of Injury in the United States: A Report to Congress. San Francisco, CA: Institute for Health & Aging, University of California and Injury Prevention Center, The Johns Hopkins University, 1989.

4. National Center for Health Statistics. Vital Statistics of the United States, 1987, Volume II - Mortality, Part A. Hyattsville, Md.: National Center for Health Statistics, 1989.

5. North Carolina Department of Transportation, Division of Motor Vehicles, Traffic Data Branch, Collision Reports Section. North Carolina Traffic Accident Facts. Raleigh, N.C., 1988.

6. North Carolina Department of Environment, Health, and Natural Resources, Office of Chief Medical Examiner. Annual Report 1988. Raleigh, N.C., 1988.

7. Waller, P.F.; Stewart, J.R.; Hansen, A.R.; Stutts, J.C.; Lederhaus-Popkin, C.; Rodgman, E.A. "The Potentiating Effects of Alcohol on Driver Injury, <u>Journal of the American Medical Association</u>. Vol. 256, 1461-6: 1986.

8. National Committee for Injury Prevention and Control, Education Development Center, Inc., <u>Injury Prevention: Meeting the Challenge</u>. New York; Oxford University Press, 1989, p. 119.

9. North Carolina Department of Human Resources, State Center for Health Statistics. <u>Leading Causes of Mortality: North Carolina Vital Statistics, Volume 2, 1981</u>. Raleigh, September 1983.

10. National Highway Traffic Administrations. Final Rule, FMVSS 208: Occupant Crash Protection, 49 CPR, part 571. Washington, D.C., 1984.

11. National Committee for Injury Prevention and Control, Education Development Center, Inc. <u>Injury Prevention: Meeting the Challenge</u>. New York, New York: Oxford University Press, 1989.

12. Patetta, M.J., "A Descriptive Analysis of Housefire Deaths in North Carolina," <u>SCHS Studies</u>. No. 46, N.C. Department of Human Resources, Raleigh, N.C., 1988.

13. Patetta, M.J., "Drowning Deaths in North Carolina," <u>SCHS Studies</u>. No. 42, N.C. Department of Human Resources, Raleigh, N.C., 1986.

14. Governor's Task Force on Injury Prevention and Control. <u>Injury In North Carolina</u>. North Carolina Department of Environment, Health, and Natural Resources, Raleigh, N.C., 1989.

15. Surles, K., Sullivan, L., Nelson, M. "Health of the Elderly in North Carolina: Population at Risk and Patterns and Trends in Mortality," SCHS Studies. No. 51, N.C. Department of Human Resources, Raleigh, N.C. 1989.

16. Osgood, N. Suicide in the Elderly: A Practitioner's Guide to Diagnosis and Mental Health Intervention. Rockville, M.D.: Aspen Systems Corporation, 1985.

17. Miller, M. Suicide After Sixty: The Final Alternative. New York, N.Y.: Springer Publishing Company, Inc., 1979.

18. Sainsbury P. "The Epidemiology of Suicide," Suicide, Alec Roy, ed. Baltimore, Md.: Williams and Wilkins, 1986.

19. North Carolina Department of Justice. Crime in North Carolina, 1988, Raleigh, N.C.: State Bureau of Investigation, 1989.

20. University of California at Los Angeles, Centers for Disease Control: The Epidemiology of Homicide in the City of Los Angeles, 1970-79. Department of Health and Human Services, Public Health Service, Centers for Disease Control, August 1985.

21. Rushforth, N., et al. "Violent Death in a Metropolitan County: Changing Patterns in Homicide, 1958-74." N Engl J Med, 1977; 197:531-42.

VIII. INFANT MORTALITY

INFANT MORTALITY

After steady decreases for many years, North Carolina's infant mortality has risen each of the last two years. From 11.6 infant deaths per 1,000 live births in 1986, the rate rose to 12.1 in 1987 and 12.6 in 1988. In 1988, 1227 North Carolina babies died before age 1. Consequently, in 1988 North Carolina had the highest infant mortality rate in the United States, followed by Mississippi with the second highest. In 1988, North Carolina's infant mortality rate was 27% higher than the provisional United States rate of 9.9. (1)

During the period of steady decline in the infant mortality rate, beginning in the mid - 1970's, the state's Perinatal Care Program was developed with the goal of improving pregnancy outcome. With the operation of this program there occurred a general shift of deliveries from small hospitals to larger ones and a doubling of the percentage of very low birthweight deliveries occurring in hospitals with newborn intensive care units. Both of these occurrences aided in reducing infant mortality as did social and economic improvements over the period.

Low birthweight, which is the strongest risk factor for infant mortality, has shown relatively little improvement over the same period. The percent of births weighing less than 2500 grams (5 lbs., 8 oz.) was 8.7 in 1975, 7.9 in 1980, and 8.0 in 1988. This decline of 8 percent compares to a reduction in the infant mortality rate of 32 percent from 1975 to 1988. As further improvements in survival due to the expansion of newborn intensive care diminish, the lack of progress in preventing low-weight births is becoming evident in the recent unfavorable trend in infant mortality.

Of major concern is the persistent difference in infant mortality between whites and nonwhites. In 1975 the nonwhite rate was 1.8 times the white rate; by 1988 this gap had actually increased to 1.9 (white rate 9.6, nonwhite rate 18.7). Much of this difference is due to the high percent of low-weight births among nonwhites, which is about twice the percent for whites.

RISK FACTORS

Certain characteristics of the mother and infant that are recorded on the birth certificate have shown to be associated with excessive infant mortality. In addition to low birthweight and race, which were discussed above, these characteristics include: maternal age under 18; education less than twelve years; birth order greater than three; birth out of wedlock; and the experience of having had a previous live born who died or a previous fetal death (2). Low birthweight, low education levels, large family size, fetal mortality, out-of-wedlock birth, and teenage pregnancy are all inter-related and tend to occur more frequently among nonwhites and persons of lower socioeconomic status. Efforts to improve education levels, employment, housing, and incomes will have a direct, positive impact on infant mortality. Infant mortality cannot be separated from its broader context of under-development and poverty.

Proposals to improve infant mortality frequently consist exclusively of efforts to increase levels of prenatal care for women who are already pregnant. Inadequate prenatal care is an important risk factor for infant mortality, but simply increasing prenatal visits is not enough. The content of prenatal care is crucial and, especially for low-income women, must include in addition to obstetrical medical care services such as education, nutrition, counseling, and case management (3,4).

But prenatal care alone cannot be expected to substantially improve the serious and worsening problem of infant mortality in North Carolina. As indicated above, problems related to race and poverty must also be addressed. Also, pregnancy prevention is a critical component. Over 45 percent of reported pregnancies in North Carolina each year are either induced abortions or births to unmarried women or women under age 18. Many of these pregnancies are unintended and their prevention would reduce the rates of both abortion and infant mortality. Unmarried women and those under age 18 have nearly double the infant mortality rate of women who are married or age 18 and over. Teenagers account for less than 25 percent of these "unintended" births. An effort to prevent high-risk pregnancies in all childbearing age groups is essential to reducing infant mortality. Comprehensive prenatal care for high-risk women who do become pregnant is an important second line of defense.

GEOGRAPHIC PATTERNS

As shown in Figure 17, eastern North Carolina is the major area of high risk for infant mortality. These high rates are due in large part to the higher proportion of nonwhite births in these counties, combined with the much higher overall risk of infant mortality for nonwhites. (The higher proportion of nonwhite births in North Carolina as compared to the United States accounts for about half of the difference in infant mortality between North Carolina and the United States. The rates for each race are also considerably higher in North Carolina.)

Utilizing procedures described in Section II of this report, the map below shows a statistically significant cluster of high-rate counties in the far eastern part of the state (Washington, Tyrrell, and Hyde), along with two other counties with very high rates (Polk and Warren). Each of these rates is, however,

based on less than 25 infant deaths in the numerator over the five-year period 1984-88 and therefore will have some degree of statistical error. In the 1979-81 period, other clusters were identified (5). The reader is thus cautioned not to single out these counties as the focus of the serious and widespread infant mortality problem in North Carolina.

INFANT DEATHS

MORTALITY RATES PER 1,000 LIVE BIRTHS

■ 17.34 to 23.33 (p<=.05)
□ 3.13 to 16.83

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
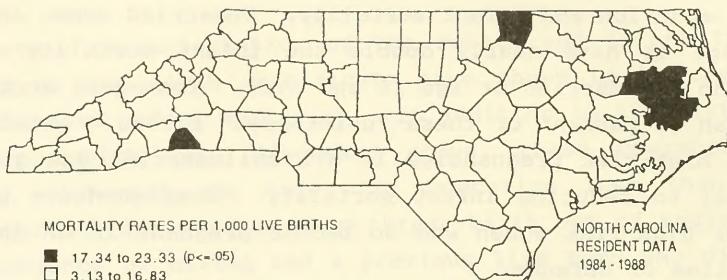
With the highest rate in the nation in 1988, North Carolina's infant mortality problem presents a real challenge to health professionals concerned with the delivery of pregnancy prevention and prenatal care services, as well as to those responsible for improving the poor socioeconomic environment which underlies much of the problem.

M O R T A L I T Y S T A T I S T I C S F O R 1 9 8 8

N O R T H C A R O L I N A R E S I D E N T S

I N F A N T D E A T H S (P E R 1 0 0 0 L I V E B I R T H S)

GEOGRAPHICAL AREA	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
NORTH CAROLINA	1227	12.57	5557	12.16	0.00
REGIONS					
OHR I WESTERN	402	12.71	1684	11.53	0.00
OHR II N. CENTRAL	235	12.34	1080	12.25	0.00
OHR III S. CENTRAL	332	13.20	1488	12.76	0.00
OHR IV EASTERN	258	11.85	1305	12.30	0.00
HSA I WESTERN	170	12.26	710	10.83	0.00
HSA II PIEDMONT	200	11.94	921	11.90	0.00
HSA III S. PIEDMONT	232	13.06	974	12.11	0.00
HSA IV CAPITAL	169	11.51	857	12.87	0.00
HSA V CARDINAL	224	13.85	955	12.40	0.00
HSA VI EASTERN	232	12.62	1140	12.69	0.00
COUNTIES					
1 ALAMANCE	15	9.89	66	9.74	0.00
2 ALEXANDER	3	9.37	19	11.27	0.00
3 ALLEGHANY	2	22.98	6	13.30	0.00
4 ANSON	7	17.54	27	15.06	0.00
5 ASHE	5	22.72	14	12.37	0.00
6 AVERY	0	0.00	3	3.13	0.00
7 BEAUFORT	10	16.92	38	13.57	0.00
8 BERTIE	1	3.16	22	13.91	0.00
9 BLADEN	5	12.53	30	15.89	0.00
10 BRUNSWICK	4	5.83	25	7.55	0.00
11 BUNCOMBE	25	10.59	105	9.71	0.00
12 BURKE	14	14.59	41	9.02	0.00
13 CABARRUS	16	11.46	71	11.18	0.00
14 CALDWELL	21	20.79	52	11.40	0.00
15 CAMDEN	0	0.00	2	5.73	0.00
16 CARTERET	10	14.55	41	11.54	0.00
17 CASWELL	3	11.02	7	5.51	0.00
18 CATAWBA	15	8.92	90	11.92	0.00
19 CHATHAM	7	12.02	31	11.64	0.00
20 CHEROKEE	1	4.67	8	7.37	0.00
21 CHOWAN	0	0.00	10	10.44	0.00
22 CLAY	0	0.00	3	8.10	0.00
23 CLEVELAND	19	14.64	92	15.77	0.00
24 COLUMBUS	8	11.52	45	12.14	0.00
25 CRAVEN	19	11.70	92	11.57	0.00
26 CUMBERLAND	86	15.16	349	12.94	0.00
27 CURRITUCK	2	10.25	16	16.58	0.00
28 DARE	3	8.98	10	7.00	0.00
29 DAVIDSON	15	9.15	86	10.86	0.00
30 DAVIE	1	3.04	15	9.79	0.00
31 DUPLIN	9	14.97	37	12.89	0.00
32 DURHAM	30	11.04	155	12.41	0.00
33 EDGECOMBE	16	17.48	68	15.44	0.00
34 FORSYTH	52	13.48	230	13.00	0.00
35 FRANKLIN	6	12.04	32	14.12	0.00
36 GASTON	37	13.80	179	14.47	0.00
37 GATES	1	8.19	10	15.87	0.00
38 GRAHAM	0	0.00	2	4.36	0.00
39 GRANVILLE	12	23.12	39	15.70	0.00
40 GREENE	4	22.09	14	13.91	0.00
41 GUILFORD	66	13.43	303	13.53	0.00

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

COUNTIES (CONT'D)	NUMBER OF DEATHS 1988	DEATH RATE* 1988	NUMBER OF DEATHS 1984-88	DEATH RATE* 1984-88	ADJUSTED DEATH RATE* 1984-88
42 HALIFAX	15	16.85	58	13.75	0.00
43 HARNETT	22	18.64	68	12.21	0.00
44 HAYWOOD	5	9.39	21	8.02	0.00
45 HENDERSON	9	12.09	41	10.58	0.00
46 HERTFORD	4	11.33	19	10.88	0.00
47 HOKE	5	12.75	21	11.45	0.00
48 HYDE	1	16.12	6	17.34	0.00
49 IREDELL	24	19.59	80	13.88	0.00
50 JACKSON	1	3.43	16	11.72	0.00
51 JOHNSTON	16	13.78	59	11.06	0.00
52 JONES	0	0.00	10	15.03	0.00
53 LEE	7	11.04	37	12.07	0.00
54 LENOIR	8	10.10	57	14.53	0.00
55 LINCOLN	5	6.88	28	8.82	0.00
56 MCDOWELL	8	17.24	33	14.93	0.00
57 MACON	1	4.16	13	10.97	0.00
58 MADISON	1	5.37	7	7.70	0.00
59 MARTIN	4	11.49	25	13.65	0.00
60 MECKLENBURG	108	13.08	429	11.72	0.00
61 MITCHELL	1	5.00	5	5.47	0.00
62 MONTGOMERY	8	24.53	24	15.46	0.00
63 MOORE	10	13.92	36	9.99	0.00
64 NASH	15	13.16	77	14.32	0.00
65 NEW HANOVER	11	6.69	72	9.51	0.00
66 NORTHAMPTON	7	24.91	22	14.79	0.00
67 ONSLOW	39	11.73	192	11.54	0.00
68 ORANGE	12	10.63	59	11.33	0.00
69 PAMLICO	1	6.84	11	15.66	0.00
70 PASQUOTANK	3	5.85	27	11.54	0.00
71 PENDER	3	8.08	23	13.85	0.00
72 PERQUIMANS	2	13.79	9	12.34	0.00
73 PERSON	7	17.03	24	12.43	0.00
74 PITT	28	17.38	110	14.83	0.00
75 POLK	4	26.49	13	19.64	0.00
76 RANDOLPH	15	10.20	67	9.92	0.00
77 RICHMOND	12	18.26	50	16.82	0.00
78 ROBESON	28	15.14	119	13.31	0.00
79 ROCKINGHAM	12	10.21	61	10.91	0.00
80 ROWAN	20	13.74	78	11.13	0.00
81 RUTHERFORD	13	16.86	32	8.77	0.00
82 SAMPSON	9	13.95	34	11.05	0.00
83 SCOTLAND	6	11.23	32	12.42	0.00
84 STANLY	6	8.16	29	8.70	0.00
85 STOKES	2	4.40	16	7.43	0.00
86 SURRY	15	19.43	54	15.02	0.00
87 SWAIN	3	14.92	10	11.70	0.00
88 TRANSYLVANIA	2	6.55	17	11.78	0.00
89 TYRRELL	1	18.86	7	23.33	0.00
90 UNION	16	12.49	80	13.72	0.00
91 VANCE	6	9.47	42	14.59	0.00
92 WAKE	62	10.06	357	13.17	0.00
93 WARREN	4	16.87	22	18.60	0.00
94 WASHINGTON	7	29.66	22	20.83	0.00
95 WATAUGA	3	8.17	18	9.45	0.00
96 WAYNE	17	10.60	85	10.71	0.00
97 WILKES	12	17.46	42	11.48	0.00
98 WILSON	5	5.38	43	9.37	0.00
99 YADKIN	4	11.66	16	9.27	0.00
100 YANCEY	2	9.95	7	7.93	0.00

* SEE SECTION II; RATES BASED ON SMALL NUMBERS MAY BE UNRELIABLE.

INFANT DEATHS

MORTALITY RATES PER 1,000 LIVE BIRTHS

- ■ 23.33 to 23.33
- ■ 18.80 to 20.83
- ▓ 12.89 to 17.34
- ▨ 10.45 to 12.44
- □ 7.00 to 9.99
- □ 3.13 to 5.73
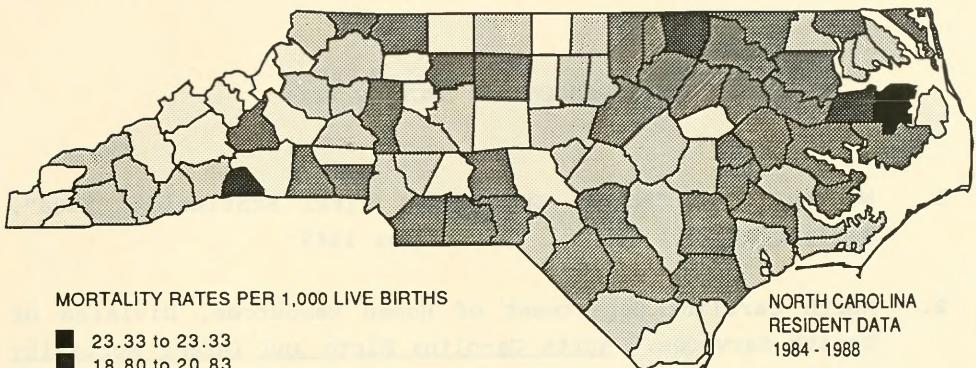
NORTH CAROLINA
RESIDENT DATA
1984 - 1988

FIGURE 17

REFERENCES FOR SECTION VIII

1.   Wegman, M.E. "Annual Summary of Vital Statistics, 1988",
      Pediatrics, Vol 84, No. 6, December 1989.

2.   North Carolina Department of Human Resources, Division of
      Health Services. North Carolina Birth and Infant Mortality
      Statistics 1986, Volume 1. Raleigh, N.C., April 1988.

3.   Institute of Medicine. Preventing Low Birthweight. Wash-
      ington D.C., National Academy Press. 1985.

4.   Buescher PA, Smith C, Holliday JL, Levine RH. "Source of
      Prenatal Care and Infant Birthweight: The Case of a North
      Carolina County," American Journal of Obstetrics and
      Gynecology 1987; 156: 204-210.

5.   North Carolina Department of Human Resources, State Center
      for Health Statistics. Leading Causes of Mortality: North
      Carolina Vital Statistics, Volume 2, 1981. Raleigh, Septem-
      ber 1983.

IX. MULTIPLE CONDITIONS PRESENT AT DEATH

MULTIPLE CONDITIONS PRESENT AT DEATH

Deaths have traditionally been tabulated by the major or "underlying" cause of death. In a modern society, however, where chronic diseases and injuries have come to replace acute infectious diseases as the leading causes of mortality, it has become increasingly difficult to describe each death by only one cause. In North Carolina, all conditions mentioned on the death certificate have been coded since 1975. Since then, it is possible to look at multiple conditions at death in a systematic manner.

In 1982 the Center for Health and Environmental Statistics (previously the State Center for Health Statistics) published Multiple Conditions Present at Death: A Special Study (1), which examined in detail the history of multiple-condition coding, trends from 1969 to 1978 in multiple causes of death, and data for the most recent years then available (1979 and 1980). Readers with a particular interest in this topic are referred to that publication. Copies are available from the Center for Health and Environmental Statistics.

In 1988, 77.8 percent of North Carolina residents had more than one condition mentioned on the death certificate, with 78.4 percent of white decedents and 76.1 percent of nonwhite decedents having more than one condition mentioned. This percentage was 76.0 for males versus 79.9 for females.

The percentage of deaths with more than one condition mentioned was 62.5 percent for infants, decreasing to a low of 28.4 at ages 15-24, and then increasing steadily through the older ages to 85.7 percent at ages 85 and older.

In a recent study entitled Health of the Elderly in North Carolina: Population at Risk and Patterns and Trends in Mortality (2), the Center for Health and Environmental Statistics examined mentioned-conditions data for older decedents. In the age groups 65-74, 75-84, and 85 and older, atherosclerosis, hypertension, and anemias were found to be reported as mentioned conditions 10 to 30 times as often as they were reported as underlying causes of death. Just as elderly mortality rates for underlying cause are higher for males than for females, so are most of the major mentioned-conditions rates, e.g., atheroslerosis and pneumonia/influenza rates. The mentioned-conditions rates for these older age groups are also higher among nonwhites than among whites for hypertension, diabetes, and nephritis/nephrosis/nephrotic syndrome A more detailed analysis can be found in the referenced report (2).

Table 22 displays rates for the 15 leading underlying causes of death in 1988, first ranked by underlying cause and then by number of mentioned conditions per 100,000 population. These rates at best reflect morbidity just among those persons who die. And even this implies a completeness of reporting that is not actually present, since the certificate asks for only conditions "contributing to death" and medical certification may not reflect all conditions present at death. Nevertheless, a comparison of the two lists of Table 22 does identify causes contributing to death that are much more prevalent than counts relying solely on underlying cause would indicate. Note that heart disease and cancer rates top both the underlying-cause and mentioned-conditions lists.

An examination of race-sex variations among 1988 mentioned-conditions rates reveals that nonwhites experience higher rates than do whites for hypertension, diabetes, septicemia, nephritis/nephrotic syndrome/nephrosis, chronic liver disease and cirrhosis, homicide, and prostate cancer. For atherosclerosis, white males and white females have similar rates (199.5 and

202.6), with nonwhite males and nonwhite females having similar, though lower, rates of 152.2 and 158.3. The sex-specific rates are also similar within race for colon cancer: white males and white females at 24.2 and 25.0, respectively, and nonwhite males and nonwhite females at 22.0 and 22.5, respectively.

Females exhibit higher mentioned-condition rates than males for hypertension and cerebrovascular disease. Male rates are higher than female rates for pneumonia/influenza, nephritis/nephrosis/nephrotic syndrome, chronic liver disease and cirrhosis, heart disease, and cancer, particularly lung cancer.

Table 23 shows the number of deaths by underlying cause (first column) and then the number of certificates with a given underlying cause (each row) that had a mention of other conditions. For example, there were 1,326 deaths in 1988 with diabetes as the underlying cause, and 210 of these deaths also had a mention of nephritis, nephrotic syndrome, or nephrosis on the certificate (second page of Table 23, row 21, column 26). In total, 4,894 death certificates had a mention of diabetes in 1988 (second page of Table 23, column 21, bottom row).

Table 24 shows the number of deaths for which selected pairs of conditions were mentioned, without any consideration of the underlying cause. For example, 460 death certificates (out of a total of 57,630) had both diabetes and nephritis, nephrotic syndrome, or nephrosis mentioned (second page of Table 24, row 21, column 26). As in Table 23, the bottom row shows the total number of certificates with a mention of each of the conditions. For additional information about relationships in Tables 23 and 24, see Multiple Conditions Present at Death: A Special Study (1).

Table 25 compares the mentioned-conditions rates of 1981 and 1988. The mentioned-conditions rates for heart disease, athero-

TABLE 22

DEATHS PER 100,000 POPULATION BY CAUSE:
RANKED BY UNDERLYING CAUSE AND MENTIONED CONDITIONS
NORTH CAROLINA RESIDENTS, 1988

1988 Deaths with Cause as Underlying Cause	Number	Rate
Diseases of Heart	19421	299.4
Cancer	12700	195.8
Cerebrovascular Disease	4780	73.7
Chronic Obstructive Lung Disease	2098	32.3
Pneumonia and Influenza	1930	29.8
All Other Accidents and Adverse Effects	1616	24.9
Motor Vehicle Accidents	1598	24.6
Diabetes Mellitus	1326	20.4
Suicide	784	12.1
Chronic Liver Disease and Cirrhosis	711	10.8
Homicide	578	8.9
Septicemia	531	8.2
Nephritis, Nephrotic Syndrome, and Nephrosis	469	7.2
Atherosclerosis	414	6.4
Hypertension	283	4.4

1988 Deaths with Cause Mentioned: Cause	Number	Rate
Disease of Heart	30466	469.6
Cancer	14279	220.1
Atherosclerosis	12329	190.0
Cerebrovascular Disease	8570	132.1
Pneumonia and Influenza	5455	84.1
Chronic Obstructive Lung Disease	5396	83.2
Diabetes Mellitus	4894	75.4
Hypertension	4858	74.9
All Other Accidents and Adverse Effects	3645	56.2
Nephritis, Nephrotic Syndrome, and Nephrosis	3149	48.5
Septicemia	3015	46.5
Motor Vehicle Accidents	1613	24.9
Chronic Liver Disease and Cirrhosis	1052	16.2
Suicide	791	12.2
Homicide	585	9.0

NOTE: The mentioned conditions include the underlying cause.

TABLE 23

DEATHS BY SELECTED UNDERLYING CAUSE WITH FREQUENCY OF MENTIONED CONDITIONS, NORTH CAROLINA RESIDENTS, 1988

Underlying Cause of Death	Total Under-lying*	Conditions Mentioned on Death Certificate (Numbers Refer to Row Titles)														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 Diseases of heart	19,421	19,421	1,972	8,089	747	14	16	107	3	12	13	130	4	75	6	10
2 Cerebrovascular disease	4,780	1,364	4,780	1,501	152	2	2	17	3	4	0	18	0	27	3	1
3 Atherosclerosis	414	248	0	414	26	0	0	5	0	1	1	2	0	0	0	0
4 Cancer	12,700	2,832	354	474	12,700	249	332	1,355	190	678	98	3,694	210	1,120	149	310
5 Lip	234	44	10	8	234	234	0	0	0	0	4	0	0	0	0	0
6 Stomach	324	73	8	14	324	0	324	0	1	1	0	0	0	1	0	2
7 Colon, rectum, rectosigmoid junction & anus	1,331	284	33	49	1,331	0	1	1,331	3	2	0	4	1	3	0	0
8 Liver	185	37	2	7	185	0	1	1	185	2	0	0	1	0	0	2
9 Pancreas	671	140	10	19	671	0	0	0	0	671	0	4	1	3	0	0
10 Larynx	86	20	4	4	86	3	0	1	0	0	86	1	0	0	0	1
11 Trachea, bronchus and lung	3,669	777	84	136	3,669	5	1	7	0	0	5	3,669	1	7	2	0
12 Malignant melanoma	204	29	5	3	204	0	0	0	0	0	0	1	204	1	2	0
13 Female breast	1,093	183	25	28	1,093	0	0	5	0	1	0	2	0	1,093	0	2
14 Cervix uteri	142	34	2	4	142	0	0	1	0	0	0	0	0	0	142	0
15 Ovary & other uterine adnexa	304	78	0	7	304	2	2	0	0	1	1	3	0	3	0	304
16 Prostate	839	257	38	56	839	2	2	1	0	0	0	3	0	0	0	0
17 Bladder	215	63	10	18	215	1	0	1	0	1	1	0	0	0	0	0
18 Brain tumors	298	57	12	9	298	0	0	0	0	0	0	1	1	0	0	0
19 Non-Hodgkins lymphoma	398	97	16	16	398	0	0	0	0	0	0	2	1	2	0	1
20 Leukemia	452	115	25	14	452	0	0	2	0	0	1	2	0	1	2	0
21 Diabetes Mellitus	1,326	910	299	435	33	1	2	9	0	0	1	4	0	4	1	0
22 Pneumonia & Influenza	1,930	660	252	237	103	1	2	8	0	2	3	18	4	12	2	0
23 Chronic obstructive pulmonary disease & allied cond.	2,098	1,005	107	222	120	4	1	14	0	3	6	49	4	6	1	0
24 Chronic liver disease and cirrhosis	701	154	15	18	18	1	1	1	2	0	1	4	0	1	0	0
25 Septicemia	531	248	77	37	23	0	1	2	2	2	0	6	0	5	0	0
26 Nephritis, nephrotic syndrome & nephrosis	469	291	47	59	22	0	0	3	1	0	0	5	0	4	1	0
27 Motor vehicle accidents—unintentional injuries	1,598	82	9	10	2	0	0	0	0	1	0	0	0	0	0	0
28 All other unintentional injuries & adverse effects	1,616	375	70	68	33	3	1	3	0	0	2	5	0	7	0	1
29 Suicide	784	22	1	2	19	0	0	2	0	0	2	2	0	0	0	0
30 Homicide	578	18	0	1	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL DEATHS**	57,630	30,466	8,570	12,329	14,279	282	358	1,558	197	709	133	3,975	220	1,302	167	323

TABLE 23 — continued

DEATHS BY SELECTED UNDERLYING CAUSE WITH FREQUENCY OF MENTIONED CONDITIONS, NORTH CAROLINA RESIDENTS, 1988

Conditions Mentioned on Death Certificate (Numbers Refer to Row Titles)

	Underlying Cause of Death	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Alcohol	Hypertension
1	Diseases of heart	155	32	6	29	32	1,941	853	1,584	113	262	887	9	543	0	0	226	2,588
2	Cerebrovascular disease	33	6	0	9	7	425	442	182	19	172	115	0	245	0	0	31	852
3	Atherosclerosis	8	3	0	0	1	35	39	19	2	10	63	0	22	0	0	1	0
4	Cancer	882	227	301	427	473	405	793	807	44	436	416	0	316	0	0	54	290
5	Lip	0	0	0	0	1	10	18	10	0	7	1	0	8	0	0	5	5
6	Stomach	0	0	0	1	2	9	14	12	2	9	5	0	9	0	0	3	7
7	Colon, rectum, rectosigmoid junction & anus	4	1	0	0	0	48	40	28	8	33	39	0	36	0	0	1	31
8	Liver	1	0	0	0	0	7	5	2	11	6	2	0	1	0	0	3	8
9	Pancreas	3	0	0	0	0	50	17	17	3	20	17	0	9	0	0	5	24
10	Larynx	0	0	0	0	0	5	7	10	0	2	1	0	6	0	0	3	2
11	Trachea, bronchus and lung	23	5	3	11	9	91	344	516	6	66	45	0	86	0	0	10	80
12	Malignant melanoma	0	2	0	1	0	4	10	6	0	5	6	0	4	0	0	0	6
13	Female breast	0	0	0	2	2	27	35	26	3	25	25	0	22	0	0	2	21
14	Cervix uteri	0	0	0	0	0	6	5	1	0	5	16	0	3	0	0	0	2
15	Ovary & other uterine adnexa	0	0	0	0	1	8	5	4	1	8	16	0	2	0	0	1	3
16	Prostate	839	1	0	0	0	31	47	29	0	30	70	0	15	0	0	2	26
17	Bladder	3	215	0	0	0	5	14	11	0	5	23	0	7	0	0	3	7
18	Brain tumors	1	1	298	0	0	12	25	8	0	4	1	0	8	0	0	1	4
19	Non-Hodgkins lymphoma	2	0	0	398	4	13	34	9	0	47	26	0	18	0	0	0	4
20	Leukemia	3	0	0	11	452	14	47	15	0	64	22	0	13	0	0	0	5
21	Diabetes Mellitus	5	0	0	0	3	1,326	76	34	4	116	210	0	47	0	0	16	286
22	Pneumonia & Influenza	14	2	2	7	11	124	1,930	159	27	243	122	0	29	0	0	42	51
23	Chronic obstructive pulmonary disease & allied cond.	16	5	3	0	3	80	393	2,098	14	53	74	1	61	1	0	28	74
24	Chronic liver disease and cirrhosis	0	2	0	0	0	45	37	18	696	49	69	1	24	0	0	377	14
25	Septicemia	3	0	0	0	0	49	36	18	8	531	84	0	12	0	0	4	15
26	Nephritis, nephrotic syndrome & nephrosis	0	0	0	0	3	27	46	18	8	45	469	0	14	0	0	7	13
27	Motor vehicle accidents—unintentional injuries	0	0	0	0	0	3	6	4	3	13	0	1,598	9	0	1	142	7
28	All other unintentional injuries & adverse effects	2	0	0	1	2	31	46	48	13	64	46	1	1,616	0	0	218	38
29	Suicide	3	0	0	0	0	5	2	5	2	2	2	1	4	784	0	42	2
30	Homicide	0	0	0	0	0	1	1	0	0	5	2	0	2	0	578	21	0
	TOTAL DEATHS**	1,159	281	314	489	562	4,894	5,455	5,396	1,052	3,015	3,149	1,613	3,645	791	585	1,634	4,858

*Numbers shown here are the final underlying frequencies. They are sometimes larger than numbers shown on the diagonal due to the fact that a sequence of conditions may imply an underlying cause that is not specifically mentioned on the death certificate.

**Differences between these totals and the summation over causes are attributable to causes not given in the table.

Note: In this table, a death is counted only once in a condition category although several conditions within the category may have been reported or a single condition may have been recorded more than once on the death certificate.

TABLE 24

NUMBER OF DEATHS WITH SELECTED PAIRS OF CONDITIONS MENTIONED TOGETHER, NORTH CAROLINA RESIDENTS, 1988

Conditions Mentioned on Death Certificate	Conditions Mentioned on Death Certificate (Numbers Refer to Row Titles)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 Diseases of heart	30,466	4,057	10,759	3,892	66	95	428	43	161	44	964	36	309	44	91
2 Cerebrovascular disease	4,057	8,570	2,994	604	19	12	68	4	14	5	118	5	64	8	1
3 Atherosclerosis	10,759	2,994	12,329	955	18	23	120	9	25	15	216	5	92	9	13
4 Cancer	3,892	604	955	14,279	282	358	1,558	197	709	133	3,975	220	1,302	167	323
5 Lip	66	19	18	282	282	0	1	0	0	7	7	0	0	0	0
6 Stomach	95	12	23	358	0	358	2	2	1	0	1	0	1	0	0
7 Colon, rectum, rectosigmoid junction & anus	428	68	120	1,558	1	2	1,558	2	2	0	13	1	12	1	3
8 Liver	43	4	9	197	0	2	4	197	2	0	1	0	1	0	0
9 Pancreas	161	14	25	709	7	1	2	2	709	0	4	1	4	0	1
10 Larynx	44	5	15	133	7	0	1	0	0	133	6	0	0	0	0
11 Trachea, bronchus and lung	964	118	216	3,975	7	1	13	1	4	6	3,975	2	10	2	0
12 Malignant melanoma	36	5	5	220	0	0	1	0	1	0	2	220	1	0	0
13 Female breast	309	64	92	1,302	0	1	12	0	4	0	10	0	1,302	1	5
14 Cervix uteri	44	8	9	167	0	0	1	0	0	0	2	0	1	167	0
15 Ovary & other uterine adnexa	91	1	13	323	0	0	3	0	1	0	0	0	5	0	323
16 Prostate	478	91	169	1,159	3	2	10	0	5	1	32	0	0	0	0
17 Bladder	108	21	41	281	1	0	4	0	1	1	6	2	1	1	0
18 Brain tumors	66	12	10	314	0	0	0	0	0	0	3	1	0	0	0
19 Non-Hodgkins lymphoma	137	29	35	489	0	1	0	0	0	0	12	2	4	2	1
20 Leukemia	167	39	30	562	2	2	2	0	0	1	14	1	4	2	1
21 Diabetes Mellitus	3,574	1,115	1,785	559	15	10	75	7	53	7	115	6	57	8	10
22 Pneumonia & Influenza	2,345	1,024	1,049	1,004	21	18	60	5	19	14	385	15	61	7	5
23 Chronic obstructive pulmonary disease & allied cond.	3,309	480	1,267	1,059	20	14	61	2	22	25	606	7	42	4	4
24 Chronic liver disease and cirrhosis	344	41	80	71	1	3	9	13	5	2	14	0	4	0	1
25 Septicemia	1,254	465	368	534	9	11	40	7	22	2	84	8	43	8	9
26 Nephritis, nephrotic syndrome & nephrosis	1,954	354	730	518	4	5	50	4	20	2	58	6	41	20	17
27 Motor vehicle accidents—unintentional injuries	93	9	13	2	0	0	0	0	1	0	0	0	0	0	0
28 All other unintentional injuries & adverse effects	1,441	448	496	421	14	11	47	1	10	9	98	5	43	7	4
29 Suicide	22	1	2	19	0	0	2	0	0	2	2	0	0	0	0
30 Homicide	21	0	1	0	0	0	0	0	0	0	0	0	0	0	0
31 Alcohol-related conditions	480	63	106	74	9	4	2	3	6	4	16	1	3	0	1
32 Hypertension with or without renal disease	3,682	1,501	1,433	421	7	7	48	9	25	10	93	8	51	6	3
TOTAL DEATHS**	30,466	8,570	12,329	14,279	282	358	1,558	197	709	133	3,975	220	1,302	167	323

TABLE 24 — continued

NUMBER OF DEATHS WITH SELECTED PAIRS OF CONDITIONS MENTIONED TOGETHER, NORTH CAROLINA RESIDENTS, 1988

Conditions Mentioned on Death Certificate (Numbers Refer to Row Titles)

	Conditions Mentioned on Death Certificate	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
1	Diseases of heart	478	108	66	137	167	3,574	2,345	3,309	344	1,254	1,954	93	1,441	22	21	480	3,682
2	Cerebrovascular disease	91	21	12	29	39	1,115	1,024	480	41	465	354	9	448	1	0	63	1,501
3	Atherosclerosis	169	41	10	35	30	1,785	1,049	1,267	80	368	730	13	496	2	1	106	1,433
4	Cancer	1,159	281	314	489	562	559	1,004	1,059	71	534	518	2	421	19	0	74	421
5	Lip	3	1	0	0	1	15	21	20	1	9	4	0	14	0	0	9	7
6	Stomach	2	0	0	1	2	10	18	14	3	11	5	0	11	2	0	4	7
7	Colon, rectum, rectosigmoid junction & anus	10	4	0	0	2	75	60	61	9	40	50	0	47	2	0	2	48
8	Liver	1	0	0	0	0	7	5	2	13	7	4	0	1	0	0	3	9
9	Pancreas	5	1	0	0	0	53	19	22	5	22	20	1	10	0	0	6	25
10	Larynx	1	1	0	1	1	7	14	25	2	2	2	0	9	2	0	4	10
11	Trachea, bronchus and lung	32	6	3	12	14	115	385	606	14	84	58	0	98	2	0	16	93
12	Malignant melanoma	0	2	1	2	1	6	15	7	4	4	6	0	5	0	0	1	8
13	Female breast	0	1	0	4	4	57	61	42	4	43	41	0	43	2	0	3	51
14	Cervix uteri	0	1	0	0	2	8	7	4	0	8	20	0	7	0	0	0	6
15	Ovary & other uterine adnexa	0	0	0	1	1	10	5	4	1	9	17	0	4	0	0	1	3
16	Prostate	1,159	7	1	2	4	64	89	78	3	43	93	0	27	3	0	3	46
17	Bladder	7	281	1	0	0	10	20	30	2	9	32	0	12	0	0	3	11
18	Brain tumors	1	1	314	0	0	12	29	11	0	5	1	0	10	0	0	1	4
19	Non-Hodgkins lymphoma	2	0	0	489	16	20	45	12	0	52	31	0	24	1	0	0	9
20	Leukemia	4	0	0	16	562	22	66	27	0	76	29	0	22	1	0	0	10
21	Diabetes Mellitus	64	10	12	20	22	4,894	384	322	65	325	460	4	200	5	1	59	1,146
22	Pneumonia & Influenza	89	20	29	45	66	384	5,455	845	83	579	407	7	248	1	0	128	263
23	Chronic obstructive pulmonary disease & allied cond.	78	30	11	12	27	322	845	5,396	57	183	251	5	238	6	0	106	393
24	Chronic liver disease and cirrhosis	3	2	0	0	2	65	83	57	1,052	79	98	0	55	2	0	469	36
25	Septicemia	43	9	5	52	76	325	579	183	79	3,015	390	14	248	2	5	102	125
26	Nephritis, nephrotic syndrome & nephrosis	93	32	1	31	29	460	407	251	98	390	3,149	9	169	2	2	91	99
27	Motor vehicle accidents—unintentional injuries	0	0	0	0	0	4	7	5	0	14	9	1,613	9	1	1	143	8
28	All other unintentional injuries & adverse effects	27	12	10	24	22	200	248	238	55	248	169	9	3,645	9	4	283	158
29	Suicide	3	0	0	0	1	5	2	6	0	2	2	1	4	791	0	44	2
30	Homicide	0	0	0	0	0	1	1	0	0	5	2	1	4	0	585	22	1
31	Alcohol-related conditions	3	3	1	0	0	59	128	106	469	102	91	143	283	44	22	1,634	91
32	Hypertension with or without renal disease	46	11	4	9	10	1,146	263	393	36	125	99	8	158	2	1	91	4,858
	TOTAL DEATHS*	1,159	281	314	489	562	4,894	5,455	5,396	1,052	3,015	3,149	1,613	3,645	791	585	1,634	4,858

*Differences between these totals and the summation over causes are attributable to causes not given in the table and to multiple counting of a condition if it appears in combination with more than one other condition on a certificate.

Note: In this table, a death is counted only once in a condition category although several conditions within the category may have been reported or a single condition may have been recorded more than once on the death certificate. Also, the ICD-9 codes used to count hypertension and atherosclerosis mentions are different from the codes used to count underlying cause elsewhere in this report. For further explanation, see Multiple Conditions Present at Death: A Special Study, SCHS, 1982.

TABLE 25

DEATHS WITH MENTION OF SELECTED CONDITIONS PER
100,000 POPULATION: NORTH CAROLINA RESIDENTS, 1981 AND 1988

Mentioned Condition	1981	1988
Diseases of Heart	448.1	469.6
Atherosclerosis	247.0	190.0
Cancer	188.9	220.1
Trachea, Bronchus, and Lung	46.8	61.3
Prostate	32.9	37.1
Female Breast	30.5	38.7
Colon, Rectum, and Anus	21.1	24.0
Cerebrovascular Disease	132.6	132.1
Hypertension with or without Renal Disease	72.3	74.8
Pneumonia and Influenza	67.4	84.1
Diabetes Mellitus	60.6	75.4
Chronic Obstructive Pulmonary Disease	57.0	83.2
Non-motor-vehicle Accidents and Adverse Effects	50.8	56.2
Septicemia	NA	46.5
Nephritis, Nephrosis, and Nephrotic Syndrome	40.3	48.5
Motor Vehicle Accidents	26.0	24.9
Chronic Liver Disease and Cirrhosis	16.8	16.2
Suicide	12.9	12.2
Homicide	10.6	9.0

9-11

TABLE 26

RATIO OF MENTIONED CONDITIONS TO UNDERLYING CAUSE OF DEATH
NORTH CAROLINA RESIDENTS, 1988

Mentioned Condition	Ratio
Atherosclerosis	29.8
Hypertension	17.2
Nephritis, Nephrosis, and Nephrotic Syndrome	6.7
Septicemia	5.7
Diabetes Mellitus	3.7
Pneumonia and Influenza	2.8
Chronic Obstructive Pulmonary Disease and Allied Conditions	2.6
Non-motor Vehicle Accidents and Adverse Effects	2.3
Diseases of the Heart	1.8
Cerebrovascular Disease	1.6
Chronic Liver Disease and Cirrhosis	1.6
Cancer	1.1
Prostate	1.4
Female Breast	1.2
Colon, Rectum, Anus	1.2
Trachea, Bronchus, and Lung	1.1
Motor Vehicle Accidents	1.0
Suicide	1.0
Homicide	1.0

sclerosis, cancer, and cerebrovascular disease remained the highest. The heart disease rate rose 4.7 percent, and the cancer rate rose 16.4 percent. Notable increases in two of the cancer mentioned-conditions rates were: cancer of the trachea, bronchus and/or lung (up 30.7 percent) and female breast cancer (up 26.5 percent). The atherosclerosis and homicide rates fell 23.1 and 15.1 percent, respectively, while the cerebrovascular disease rate remained the same. Mentioned-conditions rates for chronic obstructive pulmonary disease, pneumonia and influenza, diabetes, and nephritis/nephrosis/nephrotic syndrome increased 46.0, 24.6, 24.4, and 20.3 percent, respectively. The mentioned-conditions rate for septicemia increased 63.7 percent.

When mentioned conditions were first coded in North Carolina in 1975, the ratio of mentioned conditions to underlying causes was relatively small, but it increased steadily until the early eighties. In 1988, the ratio of mentioned conditions to underlying causes (Table 26) was particularly high for atherosclerosis (29.8), hypertension (17.2), nephritis/nephrosis/nephrotic syndrome (6.7), septicemia (5.7), and diabetes (3.7). These ratios are similar to the 1981 ratios for those same causes: atherosclerosis (25.4), hypertension (18.0), nephritis/nephrosis/ nephrotic syndrome (4.7), septicemia (5.6), and diabetes (4.5). Thus, the certification of mentioned conditions appears to have stabilized during the eighties.

GEOGRAPHIC PATTERNS

County maps in this section show 1984-88 mentions per 100,000 resident population for those causes with the highest ratios of mentioned condition to underlying cause of death. Figures 18 through 22 depict unadjusted and age-race-sex-adjusted mentioned-conditions rates by county for septicemia, diabetes, hypertension, atherosclerosis, and nephritis, nephrosis and nephrotic syndrome. The reader should exercise caution in inter-

preting these rates which may be affected by county-to-county differences in death certification practices. A low rate for a particular county may reflect incompleteness in the certifiers' enumerations of conditions contributing to death rather than lack of a health problem.

The geographic clustering technique described in Section II is used to produce Figures I through V which identify statistically significant contiguous groups of counties with high rates. Figure I.a reveals several clusters of high atherosclerosis rates. These clusters are defined by the following counties: (1) Gates, Perquimans, and Chowan; (2) Hyde and Beaufort; (3) Duplin, Lenoir, and Wayne; and (4) Swain, Haywood, Madison, Buncombe, McDowell, Henderson, Polk, Rutherford, and Cleveland. Upon adjustment for age, race, and sex (Figure I.b) the clusters of high atherosclerosis rates shift. In the mountains, the cluster becomes much smaller, moves to the east, and is comprised of Avery, McDowell, Burke, Caldwell, Cleveland, and Gaston counties. Other clusters for adjusted atherosclerosis rates are comprised of: Camden and Pasquotank counties; Cumberland, Bladen, and Robeson counties; and in the Coastal Plains, a large cluster extending from Johnston County east to Hyde County and from Nash County south to Duplin County.

While one large cluster in the northeast appears of high unadjusted hypertension rates (Figure II), this cluster disappears upon adjustment for age, race, and sex. Three clusters appear in the map of high unadjusted rates for nephritis, nephrosis, and nephrotic syndrome (Figure III) -- again in the northeast, as was the case with hypertension, but also in the southeast and far western parts of the state. These clusters disappear upon adjustment. The cluster map for high unadjusted septicemia rates (Figure IV.a) shows a strong regional concentration in the northeast that persists upon adjustment (Figure IV.b). Two additional septicemia clusters appear upon adjustment: one consisting of Surry, Stokes, Yadkin, Forsyth,

Iredell, and Davie counties and another in the east centering around Craven County. The cluster maps for both unadjusted (Figure V.a) and adjusted (Figure V.b) high diabetes rates indicate a strong regional concentration in the eastern part of the state. Adjusted diabetes rates also identify a cluster of high rates in the west centering around Burke County.

Thus, residents of eastern North Carolina appear to be at above-average risk for death associated with atherosclerosis, septicemia, and diabetes, after the effects of different age-race-sex distributions have been taken into account. Residents of McDowell, Burke, Caldwell, and Avery counties are at high risk for death associated with atherosclerosis and diabetes. All counties should consult Figures 18.a through 22.b to determine their relative levels of unadjusted and age-race-sex-adjusted mortality involving the five conditions examined in this section. Again, users should keep in mind that certification practices undoubtedly influence these rates.

SEPTICEMIA - MENTIONED

MORTALITY RATES PER 100,000 POPULATION

- 88.15 to 90.98
- 74.93 to 77.98
- 57.07 to 70.74
- 45.87 to 55.58
- 31.58 to 44.80
- 20.85 to 29.94

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
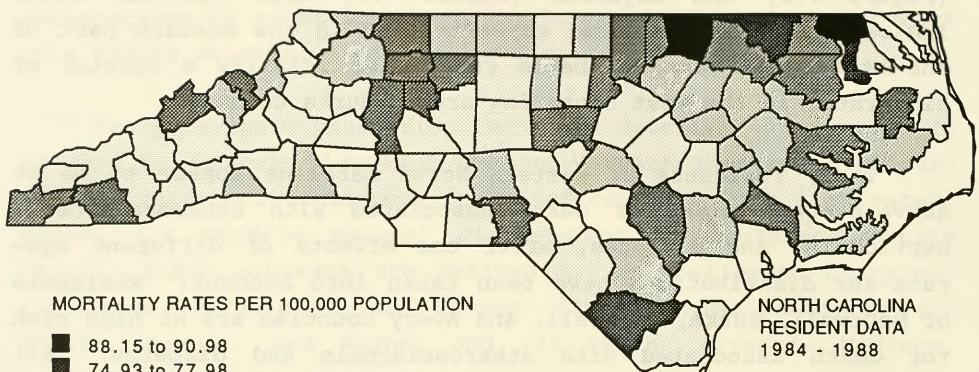
FIGURE 18.A

SEPTICEMIA - MENTIONED

AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 POPULATION

- 74.10 to 74.10
- 62.82 to 64.44
- 44.31 to 57.68
- 35.59 to 43.37
- 28.47 to 33.78
- 20.19 to 26.64

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
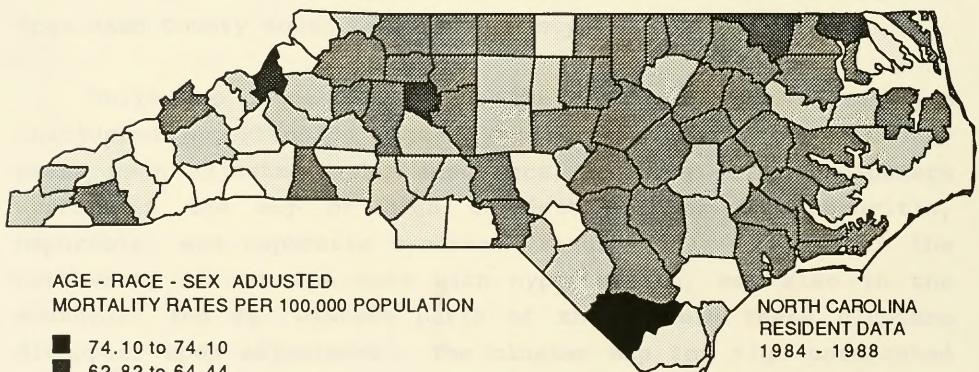
FIGURE 18.B

DIABETES MELLITUS - MENTIONED

MORTALITY RATES PER 100,000 POPULATION

■	137.52 to 137.52
■	121.89 to 121.89
▨	94.80 to 113.89
▢	65.40 to 91.49
▢	41.64 to 63.79
▢	30.76 to 37.29

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
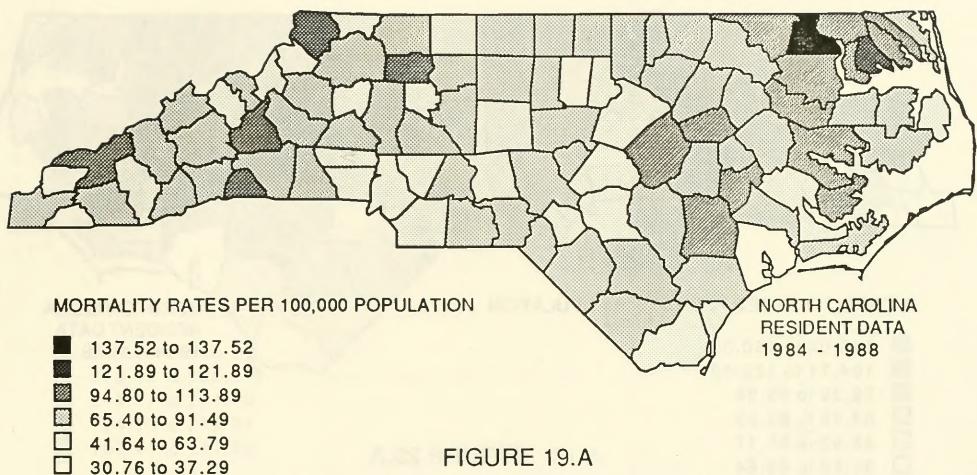
FIGURE 19.A

DIABETES MELLITUS - MENTIONED

AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 POPULATION

■	108.00 to 110.54
■	92.29 to 103.58
▨	70.44 to 90.21
▨	60.23 to 69.71
▢	43.09 to 58.25
▢	16.35 to 28.30

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
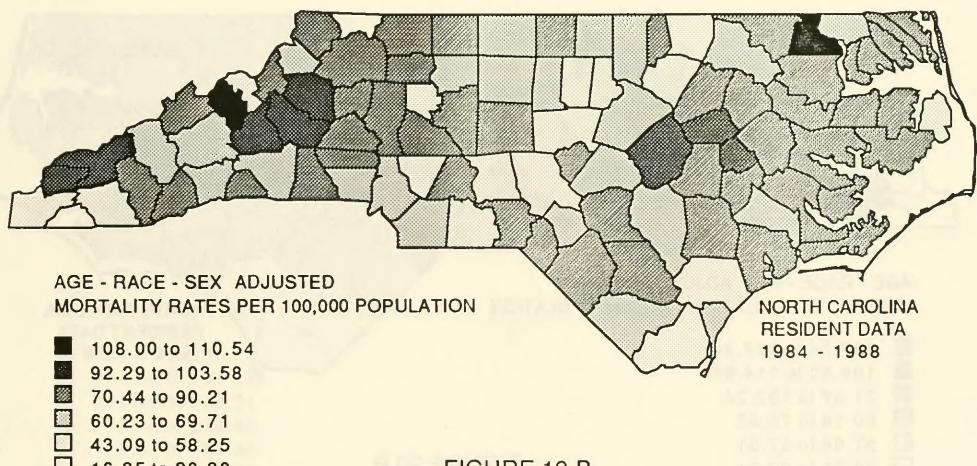
FIGURE 19.B

HYPERTENSION - MENTIONED

MORTALITY RATES PER 100,000 POPULATION

- 140.04 to 160.53
- 104.71 to 122.69
- 89.39 to 99.38
- 64.68 to 85.83
- 48.92 to 61.17
- 30.88 to 46.64

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
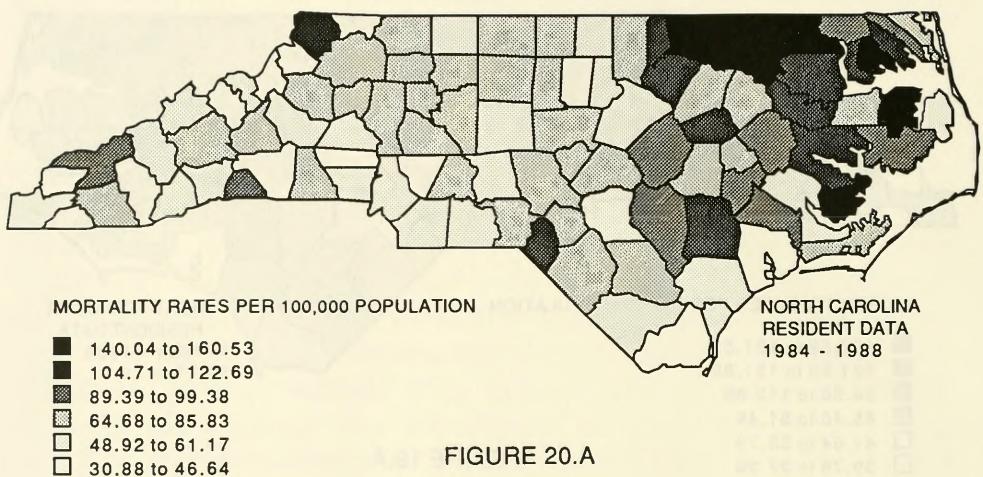
FIGURE 20.A

HYPERTENSION - MENTIONED

AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 POPULATION

- 127.24 to 127.24
- 106.50 to 114.65
- 77.97 to 102.24
- 60.14 to 75.40
- 37.04 to 57.01
- 23.35 to 28.91

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
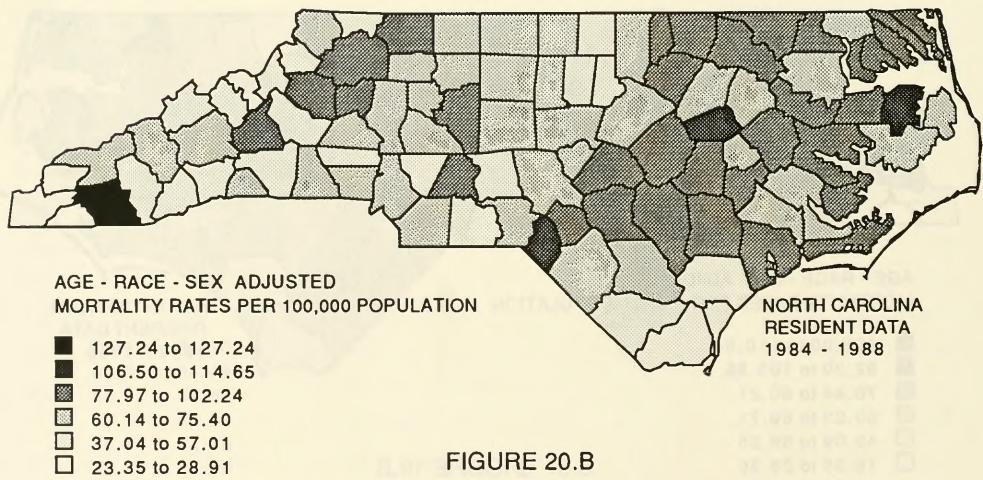
FIGURE 20.B

ATHEROSCLEROSIS - MENTIONED

MORTALITY RATES PER 100,000 POPULATION

- ■ 345.89 to 345.89
- ▨ 278.93 to 325.94
- ▨ 219.07 to 271.59
- ☐ 184.10 to 215.34
- ☐ 103.41 to 171.20
- ☐ 72.26 to 72.26

NORTH CAROLINA
RESIDENT DATA
1984 - 1988

FIGURE 21.A

ATHEROSCLEROSIS - MENTIONED

AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 POPULATION

- ■ 330.30 to 336.22
- ▨ 281.68 to 284.13
- ▨ 231.80 to 263.91
- ☐ 170.80 to 226.96
- ☐ 122.41 to 161.34
- ☐ 104.10 to 104.10

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
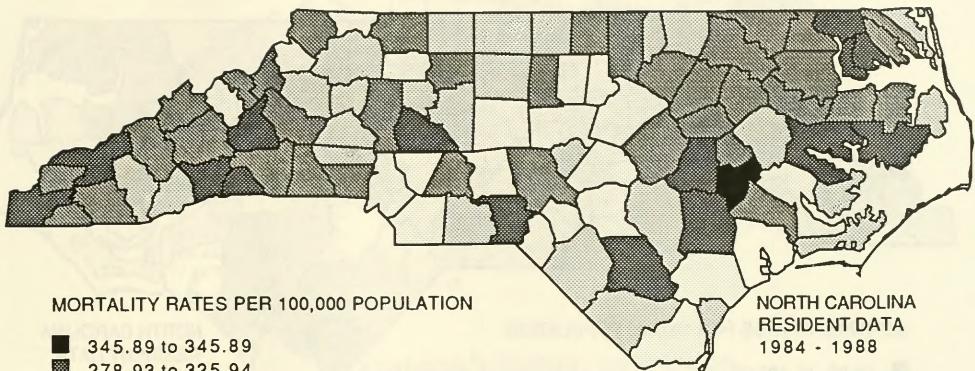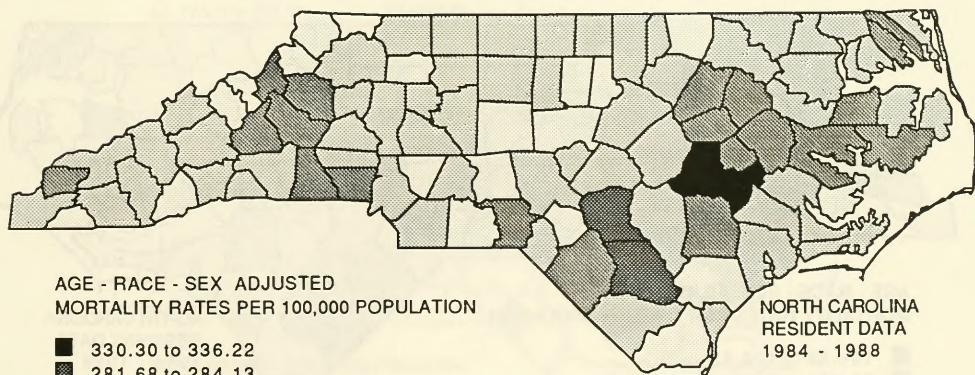
FIGURE 21.B

NEPHRITIS, NEPHROTIC SYNDROME* - MENTIONED

MORTALITY RATES PER 100,000 POPULATION

■	99.39 to 105.23
▓	88.02 to 88.02
▒	66.01 to 79.76
▫	54.31 to 64.64
☐	34.68 to 52.23
☐	23.76 to 31.30

NORTH CAROLINA
RESIDENT DATA
1984 - 1988

FIGURE 22.A
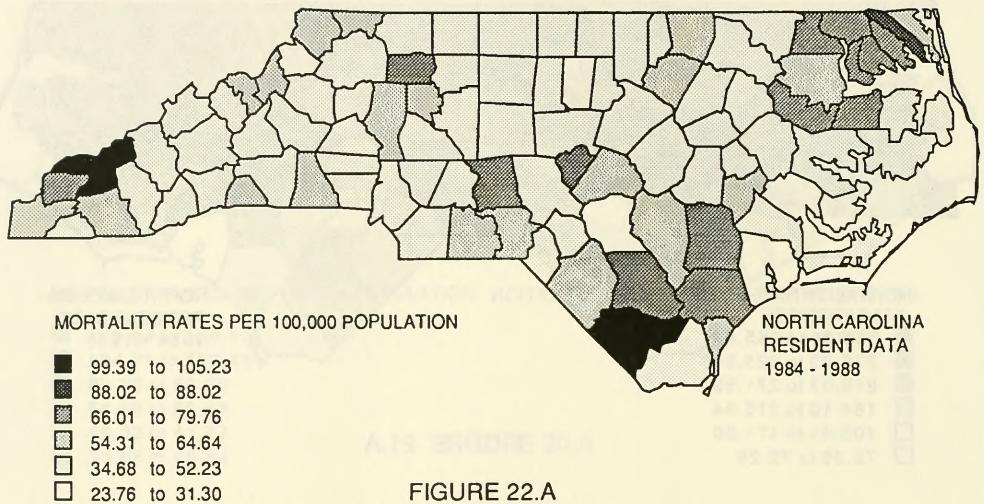
* Nephritis, nephrotic syndrome and nephrosis

NEPHRITIS, NEPHROTIC SYNDROME* - MENTIONED
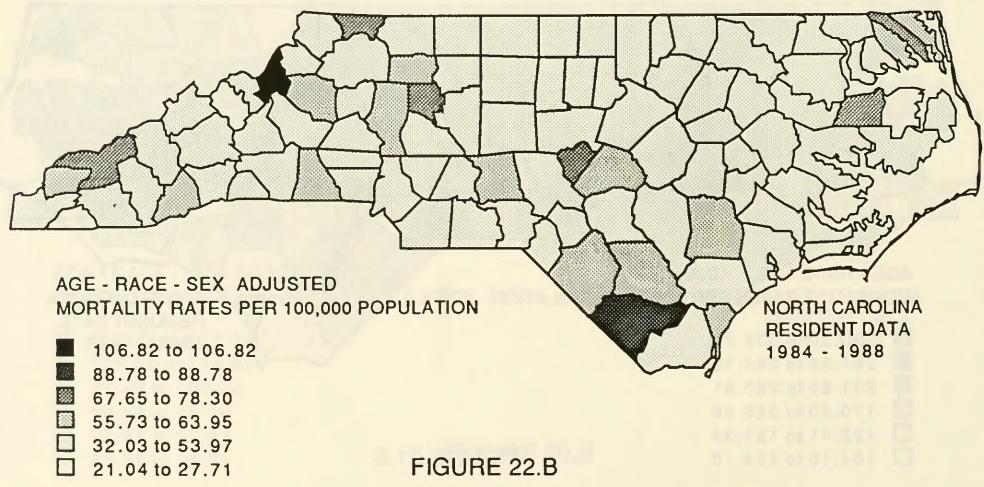
AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 POPULATION

■	106.82 to 106.82
▓	88.78 to 88.78
▒	67.65 to 78.30
▫	55.73 to 63.95
☐	32.03 to 53.97
☐	21.04 to 27.71

NORTH CAROLINA
RESIDENT DATA
1984 - 1988

FIGURE 22.B

* Nephritis, nephrotic syndrome and nephrosis

9-20

ATHEROSCLEROSIS - MENTIONED

MORTALITY RATES PER 100,000 POPULATION

- ■ 291.75 to 345.89 (p<=.05)
- ▨ 285.81 to 287.36 (p<=.05)
- ▨ 255.43 to 283.57 (p<=.05)
- □ 72.26 to 253.92

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
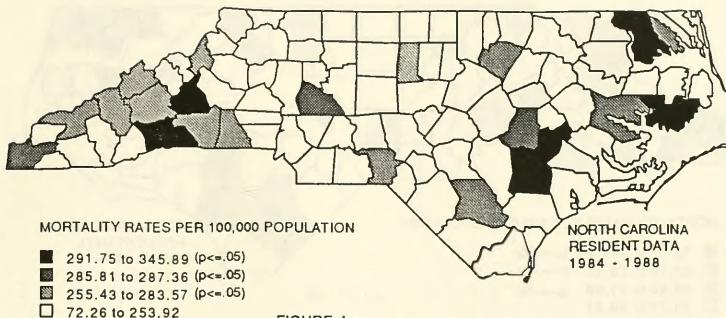
FIGURE I.a

ATHEROSCLEROSIS - MENTIONED

AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 POPULATION

- ■ 252.71 to 336.22 (p<=.05)
- ▨ 226.96 to 249.52 (p<.05)
- □ 104.10 to 225.23

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
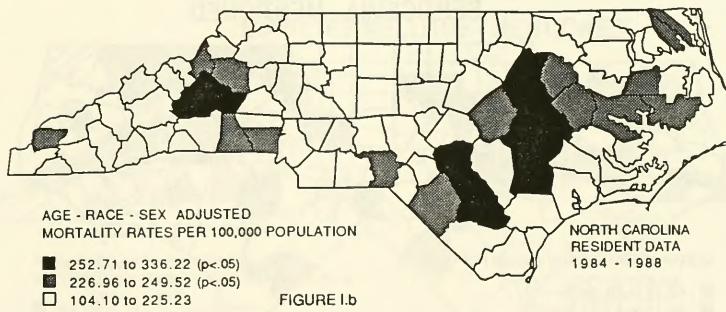
FIGURE I.b

HYPERTENSION - MENTIONED

MORTALITY RATES PER 100,000 POPULATION

- ■ 122.22 to 160.53 (p<=.05)
- ▨ 115.78 to 121.60 (p<=.05)
- ▨ 92.32 to 112.91 (p<=.05)
- □ 30.88 to 91.41

NORTH CAROLINA
RESIDENT DATA
1984 - 1988

FIGURE II

9-21

NEPHRITIS, NEPHROTIC SYNDROME* - MENTIONED

MORTALITY RATES PER 100,000 POPULATION

- ■ 70.16 to 105.23 (p<=.05)
- ▨ 63.18 to 70.15 (p<=.05)
- ▦ 60.90 to 61.86 (p<=.05)
- □ 23.76 to 60.61

* Nephritis, nephrotic syndrome and nephrosis

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
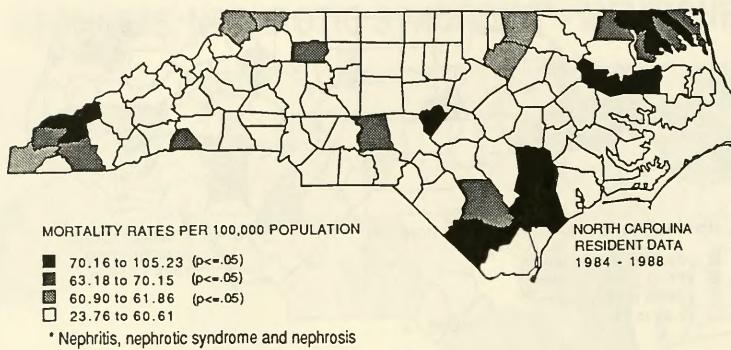
FIGURE III

SEPTICEMIA - MENTIONED

MORTALITY RATES PER 100,000 POPULATION

- ■ 65.41 to 90.98 (p<=.01)
- ▨ 60.10 to 64.05 (p<=.01)
- ▦ 57.31 to 58.45 (p<=.05)
- □ 20.85 to 57.07

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
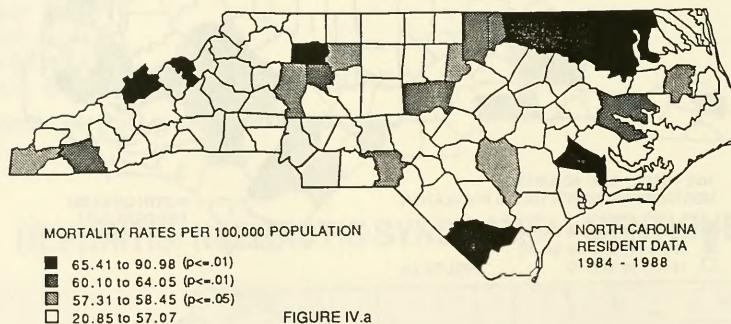
FIGURE IV.a

SEPTICEMIA - MENTIONED

AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 POPULATION

- ■ 53.95 to 74.10 (p<=.01)
- ▨ 50.19 to 53.93 (p<=.05)
- □ 20.19 to 50.12

NORTH CAROLINA
RESIDENT DATA
1984 - 1988

FIGURE IV.b

9-22

DIABETES MELLITUS - MENTIONED

MORTALITY RATES PER 100,000 POPULATION

- ■ 100.76 to 137.52 (p<=.05)
- ▨ 89.24 to 99.96 (p<=.05)
- □ 30.76 to 88.90
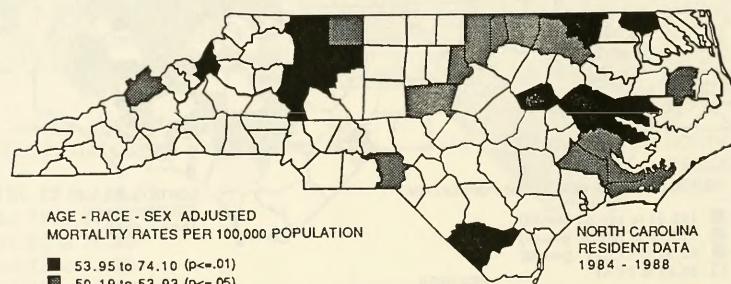
NORTH CAROLINA
RESIDENT DATA
1984 - 1988
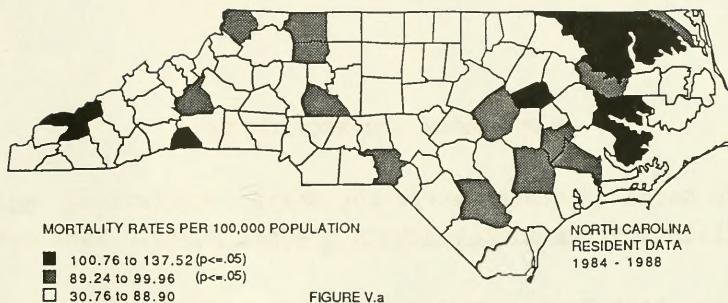
FIGURE V.a

DIABETES MELLITUS - MENTIONED

AGE - RACE - SEX ADJUSTED
MORTALITY RATES PER 100,000 POPULATION

- ■ 88.90 to 110.54 (p<=.05)
- ▨ 85.75 to 88.08 (p<=.05)
- ▧ 82.34 to 85.48 (p<=.05)
- □ 16.35 to 81.62

NORTH CAROLINA
RESIDENT DATA
1984 - 1988
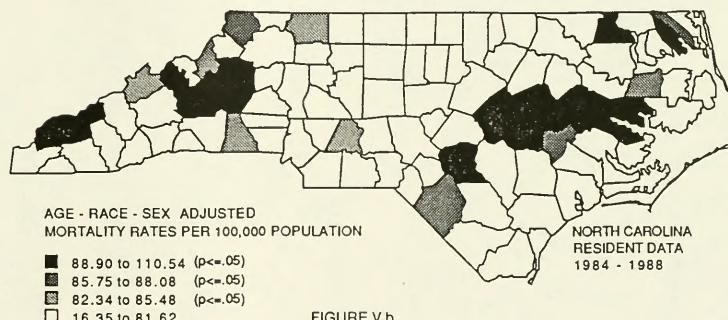
FIGURE V.b

REFERENCES FOR SECTION IX

1.   North Carolina State Center for Health Statistics.   <u>Multiple</u>
     <u>Conditions Present at Death: A Special Study</u>.   June 1982.

2.   Surles, Kathryn B., Sullivan, Lee A., and Nelson, Jr., M.D.
     <u>Health of the Elderly in North Carolina: Population at Risk</u>
     <u>and Patterns and Trends in Mortality</u>.   North Carolina State
     Center for Health Statistics.   SCHS Study No. 51, June 1989.

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